VOL. XXXV. PART 8 AUGUST, 1956

THE REVIEW OF APPLIED MYCOLOGY

Compiled from
WORLD LITERATURE ON PLANT PATHOLOGY
AND APPLIED MYCOLOGY

THE COMMONWEALTH MYCOLOGICAL INSTITUTE
KEW, SURREY

Price 6s. net

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD, BY CHARLES BATEY, PRINTER TO THE UNIVERSITY

COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW OF APPLIED MYCOLOGY

VOL. XXXV AUGUST 1956

DE CARVALHO (T.) & MENDES (O.). **Resultado das experiências com a Batata de semente no campo di ensaios da Secção de Fitopatologia.** [Result of the experiments with seed Potatoes on the trial field of the Section of Phytopathology.] —*Gaz. Agric., Moçamb.*, 8, 80, pp. 7–9, 1956.

The results of spraying experiments carried out in 1955 for the control of *Phytophthora infestans* [*R.A.M.*, 31, p. 511; 35, p. 509] and *Alternaria solani* [29, p. 89] on Up-to-Date 'seed' potato plants in the province of Tsetserra, Mozambique, are summarized and tabulated. The former pathogen was responsible for a comparatively high incidence (sometimes exceeding 20 per cent.) of tuber rot. The average number of treatments was eight, applied at 10-day intervals. The highest yield increase was given by zineb at 200 gm. per 100 l., resulting in an output of 34,370 kg. per ha. as compared with 6,181 for the unsprayed, followed by blitox (copper oxychloride) at 300 gm. (21,108). The treatment of cut seed pieces with zineb raised both the percentage of plants reaching maturity and their yields.

In 1954 and 1955 the proportion of 'degeneration' [of unspecified origin] in class A seed potatoes imported from the Union of South Africa was 10 to 15 per per cent. and not more than 7 per cent. in any lot, respectively, as against none in those of local origin.

SMITH (W. L.) & SMART (HELEN F.). **Relation of soft rot development to protective barriers in Irish Potato slices.**—*Phytopathology*, 45, 12, pp. 649–654, 3 graphs, 1955.

At the United States Plant Industry Station, Beltsville, Maryland, slices of the Irish Cobbler, Kennebec, Katahdin, Sebago, Teton, and Mohawk potato varieties were held in moist chambers at 40°, 50°, 60°, 70°, and 80° F. for one to four days and examined daily for suberin and periderm formation, the rate of which was quickest in Irish Cobbler, occurring less rapidly in the others in the above order. Slices from each temperature were inoculated daily with *Erwinia atroseptica* [*R.A.M.*, 30, p. 286; 33, p. 18] and then placed at 70°.

At each daily examination the production of suberin and periderm was more extensive on slices maintained at 70° or 80° than on those kept at lower temperatures. The barriers formed on slices held for four days at 50° or 60° were approximately equal to those maintained for two at 70° or 80°. At 40° very little suberin and no periderm developed during the four-day period.

Slices kept for two or three days at 70° or 80° before inoculation developed much less decay than those held for only one day, while the ones maintained at the high temperatures for four days before inoculation were practically free from rotting. The amount of decay in slices held at 50° or 60° for four days and then inoculated was roughly equivalent to that developing after two days at 70° or

80°. Pre-inoculation maintenance at 40° failed to prevent infection by *E. atroseptica*.

CONROY (R. J.). **Purple-top wilt of Potato.**—*Sci. Bull. Dep. Agric. N.S.W.*, 75, 12 pp., 3 pl., 1954.

The author shows that purple-top wilt of potatoes [*R.A.M.*, 33, p. 621] has probably been present in New South Wales for many years, since big bud virus of tomatoes, which causes it, was recorded in 1902. In 1951–2 [33, p. 212] there was a severe occurrence of the disease, since when it has reverted to minor significance. The outbreak then was due to migration into the crops of viruliferous leafhoppers (*Orosius argentatus*), the amount of tuber transmission being of little economic importance. 'Seed' from plants affected by purple-top wilt gives a lower emergence and has a lower yielding potential than 'seed' from healthy plants, but, owing to the generally mild effect of the disease and the absence of rapid spread in the field, a 5 per cent. tolerance is allowed for seed certification.

DAINES (R. H.). **Development of Sweetpotato scurf in storage.**—*Plant Dis. Reptr*, 39, 8, p. 617, 1955. [Photo-offset.]

Investigations at the New Jersey Agricultural Experiment Station, New Brunswick, showed that scurf (*Monilochaetes infuscans*) of sweet potato [*R.A.M.*, 30, p. 244, and next abstract] may increase and spread in storage under high relative humidity (85 to 90 per cent.), but there was no evidence of development or spread of the disease in houses where humidity was 65 to 75 per cent.

DAINES (R. H.). **Sweetpotato scurf control studies in New Jersey, 1942–1952.**—*Plant Dis. Reptr*, 39, 10, pp. 739–745, 1955. [Photo-offset.]

Treatments of 'seed', plant bed soil, and sprouts at the New Jersey Agricultural Experiment Station, New Brunswick, all controlled sweet potato scurf (*Monilochaetes infuscans*) [see preceding abstract], which is more severe and difficult to check in heavier soils than in sandy loam and is reduced at a pH range between 4·2 and 5·4. Of the seed dip treatments used, ferbam (2 and 4 lb. per 10 gals. water) and thiram (4) were the most effective. Borax (1 lb. per 5 gals., 5 minutes' soak), while showing considerable promise, occasionally caused retarded sprout emergence and blackened leaf margins. Ferbam (500 lb. per acre), worked into the soil immediately after bedding, was also effective. Of the sprout treatments tested, thiram and ferbam, both at 1 or 2 lb. per 5 gals., were the most satisfactory. Dithane Z-78, ziram, dichlone, puratized agricultural, and captan showed sufficient promise to justify further testing.

MARTIN (W. J.). **Effect of storage temperature on development of internal cork in Sweetpotato roots.**—*Plant Dis. Reptr*, 39, 8, pp. 619–621, 1955. [Photo-offset.]

The results of experiments at the Department of Horticulture, Louisiana State University, Baton Rouge, confirmed previous findings that the incidence and severity of the internal cork virus lesions on sweet potato [*R.A.M.*, 35, p. 391] increase rapidly during storage at 70° to 80° F. but to a negligible extent at 50° to 60° [32, p. 694]. The experiments further showed that in roots stored at 50° to 60° for 150 to 200 days and then kept at 80° for 14 days there was little or no increase of cork lesions. There was some increase in those transferred to 80° for 36 days, while after 56 days at 80° incidence and severity were comparable to those in roots held at 80° since harvest. This indicates that there should be sufficient time for marketing roots after their removal from cold storage before a severe increase in cork lesions occurs. Though cork lesions did not increase in roots held at 60°, there was a definite increase in those held at 65°.

WAKIMOTO (S.) & HAZIME (Y.). **Seasonal change of resistance of Rice plants against leaf-blight disease.**—*Sci. Bull. Fac. Agric. Kyushu*, 14, 4, pp. 475–477, 1954. [Japanese, with English summary.]

In experiments at Kyushu University, Japan, it was found that although when inoculated at the inception of flowering the rice variety Kidama was highly resistant to *Xanthomonas oryzae* [*R.A.M.*, 35, p. 40 and following abstracts], and Asahi (from Fukuoka) was susceptible, yet if inoculated prior to the production of the tenth leaf, the position was reversed.

WAKIMOTO (S.) & HAZIME (Y.). **On the variability of virulence of Xanthomonas oryzae under successive infection against the resistant or the susceptible variety of Rice.**—*Sci. Bull. Fac. Agric. Kyushu*, 14, 4, pp. 479–484, 1954. [Japanese, with English summary.]

The writers found that after successive transfers through the resistant rice variety Kidama the virulence of *Xanthomonas oryzae* [see preceding and following abstracts] was increased, but with the susceptible Asahi variety virulence remained the same or gradually decreased. The increased virulence obtained with Kidama was reduced after several months' culturing on solid media. No differences in serological, cultural, or physiological characters were observed between the more virulent and the original strains of the bacterium.

WAKIMOTO (S.). **Biological and physiological properties of Xanthomonas oryzae phage.**—*Sci. Bull. Fac. Agric. Kyushu*, 14, 4, pp. 485–493, 1 fig., 2 graphs, 1954. [Japanese, with English summary.]

The writer studied a bacteriophage isolated from diseased rice leaves and from paddy soil, which was specific to *Xanthomonas oryzae* [see preceding and next abstracts]. Of 25 isolates of the bacterium from different parts of Japan, three were unaffected by the phage, which was inactivated after ten minutes at 53° to 54° C. in distilled water (pH 5·8), a temperature approaching the thermal death point of *X. oryzae*. Similar exposure in Britton and Robinson's buffer solution (pH 7) resulted in inactivation at 54°, and in potato broth semi-artificial medium at 58°. In the latter medium activity of the phage decreased more slowly than in the buffer solution under similar conditions of pH and temperature, decrease being more rapid at 30° than at 5°. The phage was comparatively stable at pH 5 to 11.

WAKIMOTO (S.). **The determination of the presence of Xanthomonas oryzae by the phage technique.**—*Sci. Bull. Fac. Agric. Kyushu*, 14, 4, pp. 495–498, 1954. [Japanese, with English summary.]

At the Faculty of Agriculture, Kyushu, Japan, experiments were made on the overwintering of *Xanthomonas oryzae* on rice, using the specific bacteriophage [see preceding abstract]. It was found that *X. oryzae* could overwinter in diseased rice leaves. On unhulled grain it survived only 30 days. Soil from a field of diseased plants yielded negative results, possibly owing to the pH values being unsuitable for the phage.

BOLLE-JONES (E. W.) & HILTON (R. N.). **Zinc-deficiency of Hevea brasiliensis as a predisposing factor to Oidium infection.**—*Nature, Lond.*, 177, 4509, pp. 619–620, 2 figs., 1956.

In the course of a study of the micro-nutrient deficiency symptoms exhibited by rubber (*Hevea brasiliensis*) seedlings grown in sand culture in a plant house at the Rubber Research Institute of Malaya, Kuala Lumpur, a striking relationship was observed between susceptibility to severe infection by *Oidium heveae* [*R.A.M.*, 34, p. 397] and the zinc status of the plants.

Zinc was supplied at 0·065 p.p.m. in the 'complete' nutrient solution to selfed

seeds of clone Tjirandji 1 sown in rigorously purified sand, the same nutrient without zinc being used for controls. Three months later severe zinc deficiency symptoms occurred in the zinc-deficient cultures, including rosetting, the production of narrow, strap-like young leaves with wavy margins, chlorosis and malformation of the young laminae, death of the growing points, the production of numerous lateral shoots, and severe stunting. The plants recovered when supplied with the 'complete' solution. From the sixth month onwards the plant parts which had developed in the absence of sufficient zinc became severely infected by *O. heveae*. Adjacent plants receiving the 'complete' solution throughout, however, showed only the occasional feebly-developed colony usual on all plants in that house. In an analysis made 6½ months after sowing the 'complete' nutrient plants contained eight to ten times as much zinc per plant as the deficient ones.

SEWELL (G. W. F.). **A slide-trap method for the isolation of soil fungi.**—*Nature, Lond.*, 177, 4511, p. 708, 1 diag., 1956.

As the slide-trap method of isolating actively growing soil fungi [*R.A.M.*, 28, p. 134] was found to be too highly selective for use in a podsolized *Calluna*-heathland soil [in Surrey], a modified trap to enable a wider range of fungi to be secured was designed in the Department of Botany, Royal Holloway College. It consisted of a shallow chamber made of a perspex strip 3 by 1 by $\frac{3}{32}$ in. with lengths $\frac{1}{8}$ by $\frac{3}{32}$ in. as the four walls, and divided into unequal sections by a cross piece. Melted agar, introduced into the larger section of the chamber by means of a sterilized pipette, is spread evenly over both sections, and the chamber covered by a sterilized glass slide, fixed firmly in position by two paper clips when the agar had solidified. The traps were pushed into the soil in prepared plots so that the major part of the chamber was completely buried. After the hyphae had grown into the agar, sections were plated out separately from both parts of the chamber. The results obtained with traps agreed closely with those obtained by the immersion tube technique [20, p. 177].

ADSUAR (J.). **Susceptibility of some Sugarcane varieties to the heat treatment used in the control of chlorotic streak.**—*J. Agric. Univ. P.R.*, 40, 1, pp. 67–69, 1956. [Spanish summary.]

In view of the fact that the immersion of sugar-cane cuttings in hot water at 52° C. for 20 minutes for the control of chlorotic streak virus may adversely affect germination (Martin, J.P. Sugar Cane diseases in Hawaii, p. 112, 1938), 13 of the best varieties recommended by the Agricultural Experiment Station, University of Puerto Rico, Río Piedras [*R.A.M.*, 32, p. 644], were tested for susceptibility to this treatment. It reduced the percentage germination of M. 336, B. 41227, and Co. 281, increased it in H. 328560, P.R. 1000, B. 37161, B. 40105, B. 37172, B. 371933, P.R. 907, and P.R. 902, and had no significant effect on P.R. 905 or P.R. 980.

BRUEHL (G. W.) & GARCÍA (E. B.). **A chlorotic streak disease of Merker Grass (Pennisetum purpureum).**—*J. Agric. Univ. P.R.*, 39, 4, pp. 190–197, 3 figs., 1955. [Spanish summary. Received April, 1956.]

Symptoms of the chlorotic streak disease already recorded on *Pennisetum purpureum* in Puerto Rico [*R.A.M.*, 32, p. 510] were found in several strains of *P. purpureum* and in hybrids with *P. glaucum*. Transmission studies to determine the exact relationship between this disease and the similar sugar-cane chlorotic streak virus disease have yet to be carried out [cf. 33, p. 632].

WEHLBURG (C.). **Ratoon stunting disease in Cuba.**—*Sugar, N.Y.*, 51, 3, pp. 27–29, 2 figs., 1 diag., 1956.

Information on ratoon stunting virus disease of sugar-cane and its control is summarized from 15 contributions to the literature on the subject. It was observed

for the first time in Cuba [C.M.I. map No. 318] in several varieties of a cane collection during the spring of 1953, and a subsequent complete survey of the four mill areas on the island revealed extensive infection; several plantations, in fact, contained not a single entirely healthy field. Very satisfactory results were obtained on a commercial scale by two hours' 'seed' treatment at 51° C. in an iron tank measuring 20 by 6 by 5 ft. 8 in., mounted on a flatcar and divided into two unequal compartments. A perforated steam coil on the bottom of the smaller one heated the water which was carried to the larger (treating) compartment by a duplex pump working at a capacity of some 230 gals. per minute. The bundles of cuttings (never exceeding 1½ tons) were treated whole, resting on a wooden platform 10 in. above the bottom of the tank. A perforated iron tube was inserted into the cane bundle so that thermometer readings could be taken at the centre. Three batches of cane could be treated during an eight-hour day. The field was well prepared and furrowed at least three weeks before planting, and as an insurance against poor germination three cuttings were planted together. Germination was estimated at 94 per cent. The complete freedom from infection of 29 stools developing from stalks definitely known to be diseased before treatment and planted in separate rows afforded a guarantee that the whole 12-acre field planted with treated cane was similarly healthy.

A field experiment yielded evidence that rats can act as vectors of the virus by nibbling alternately at diseased and healthy canes. It was also transmitted to sorghum by inoculation with diseased sugar-cane tissue and back from the infected sorghum to healthy sugar-cane cuttings, which produced stools with distinct ratoon stunting symptoms after five months.

LUTTRELL (E. S.). **The ascostromatic Ascomycetes.**—*Mycologia*, 47, 4, pp. 511–532, 2 diags., 1955.

The author proposes that the series of Ascomycetes in which the asci are produced in locules in an ascostroma should be recognized as a new sub-class, corresponding to Nannfeldt's Ascoloculares [*R.A.M.*, 11, p. 606]. This is described under the name Loculoascomycetes, the composition and relationships of the member groups being shown diagrammatically and described.

LUTTRELL (E. S.). **Approaches to the classification of Helminthosporium species.**—*Plant Dis. Reptr, Suppl.* 228, pp. 111–113, 1954. [Photo-offset.]

The author discusses the need for a modern classification of *Helminthosporium* species [cf. *R.A.M.*, 3, p. 65; 30, p. 472], for which there are over 450 names, including rather more than 100 described species on grasses and cereals. In addition, a relatively small group occurs as hyperparasites on sooty mould fungi, many are saprophytes on dead wood, and others are species of economic importance parasitic on dicotyledons or other monocotyledons. The situation, which calls for persistent routine work, is considered from the point of view of type collections, morphology, and pathogenicity. A good starting-point would be a list of names to be followed by pathological studies aiming at a system of classification which is primarily of practical usefulness.

MORRIS (E. F.). **A new genus of Dematiaceae.**—*Mycologia*, 47, 4, pp. 602–605, 6 figs., 1955.

After briefly recapitulating the history of the genus *Spicularia*, the author concludes that Timonin's emendation was to a misapplication of the genus by Fuckel and the inclusion of *S. terrestris* isolated from the rhizosphere of lucerne [loc. cit.] is erroneous [*R.A.M.*, 19, p. 669]. He therefore erects a new genus, *Umbellula*, to accommodate this species and others with similar characters, and makes the new combination *U. terrestris* (syn. *S. terrestris* Timonin).

Sparrow (F. K.) & Barr (Margaret E.). **Additions to the Phycomycete flora of the Douglas Lake region. I. New taxa and records.**—*Mycologia*, 47, 4, pp. 546–556, 27 figs., 1955.

This annotated list of interesting new forms of phycomycetous fungi found in 1954 in northern Michigan [*R.A.M.*, 32, p. 452] includes a new variety, one new species each of *Dangeardia*, *Blyttiomyces*, and *Chytridium*, and 22 species already described but newly recorded.

Snethlage (P.). **Mechanisatie en ziektebestrijding in de Thee-cultuur.** [Mechanization and disease control in Tea cultivation.]—*Bergcultures*, 25, 7, pp. 183, 185, 187, 189, 191, 193, 1956. [English and Indonesian summaries.].

The results of an inquiry in 1954–5 into the extent of mechanization and disease control in the tea plantations of Java and south Sumatra are reported. Replies to a questionnaire were received from 52 out of 90 estates, covering an area of over 60,000 acres or 70 per cent. of the total under tea. The data relating to blister blight [*Exobasidium vexans*] are reproduced from a survey compiled by W. P. van der Knaap [cf. *R.A.M.*, 35, p. 240]. Control operations are carried out mainly with Ransome's M.G. tractors and Whirlwind power dusters, 80 out of the 90 available being of this make. The equipment further comprises 1,200 knapsack and 20 portable power machines. Treatments are given every five or six days, 80 to 85 per cent. of the above-mentioned area being drift-dusted and the remainder mist-blown or drift-sprayed. The total loss from pests and diseases on 30 out of 90 estates was estimated at 10 per cent. and the cost of control 5 per cent. of the cost price [? of production].

Venkataramani (K. S.). **The principles of Tea root disease control.**—*Bull. unit. Plant. Ass. S. India* 12, pp. 12–18, 1954.

Much of the information in this paper, read at the second annual conference of the United Planters' Association of Southern India, 1954, and in which the author redescribed the primary and secondary root diseases of tea and the methods for their control, has already been noticed [cf. *R.A.M.*, 35, p. 238, *et passim*]. Control of the secondary root disease associated with *Botryodiplodia theobromae* depends on improvement of the health of the bushes by careful husbandry. In the case of primary diseases, visibly affected bushes must be removed and their neighbours examined and treated if necessary, but trenching is not generally required. The use of soil fumigants is now under trial [34, p. 489].

Schmutterer (H.). **Die grüne Laubheuschrecke Tettigonia viridissima L., eine Überträgerin des Tabakmosaikvirus. (Vorläufige Mitteilung).** [The green grasshopper *Tettigonia viridissima* L., a vector of the Tobacco mosaic virus. (Preliminary note).]—*Z. PflKrankh.*, 63, 1, pp. 6–9, 1 fig., 1956. [English summary.]

In experiments at the Justus Liebig Institute, Giessen, *Tettigonia viridissima*, a not infrequent pest in German tobacco, maize, and potato fields, was shown to be a carrier of tobacco mosaic virus [cf. *R.A.M.*, 32, p. 232]. A period of five seconds' feeding on diseased source plants suffices for the acquisition of infectivity, which declines sharply, however, five minutes after feeding and is then rapidly lost altogether, presumably through inactivation by substances secreted in the insect's body.

Schramm (G.), Schneider (J. W.), & Anderer (A.). **Zur Bestimmung der Amino-Endgruppen verschiedener Hämoglobine und des Tabakmosaikvirus mit Phenylisothiocyanat.** [On the determination of the amino end groups of various haemoglobins and of Tobacco mosaic virus with phenyl*iso*thiocyanate.] —*Z. Naturf.*, 11 b, 1, pp. 12–20, 4 figs., 1 diag., 1956.

Improved methods for the separation and identification of the thiohydantoins

are fully described from the Max Planck Institute for Virus Research, Tübingen, Germany, where they were applied, *inter alia*, to a search for amino end groups in tobacco mosaic virus [*R.A.M.*, 34, p. 823 and next abstracts]. No such group could be detected, but treatment of the protein with trichloroacetic acid revealed proline as the sole amino terminal residue in the proportion of 2,400 M per M virus.

GIEBER (A.) & SCHRAMM (G.). **Die Infektiosität der Nucleinsäure aus Tabakmosaikvirus.** [The infectivity of the nucleic acid from Tobacco mosaic virus.]—*Z. Naturf.*, 11 b, 3, pp. 138–142, 1956.

The ribonucleic acid isolated from tobacco mosaic virus [see preceding and next abstracts] by two minutes' treatment with phenol was shown to possess infective properties, the action of which on *Nicotiana glutinosa* did not depend on an admixture of intact virus or on the presence of smaller quantities of native virus protein. It would appear, therefore, that ribonucleic acid is the virus component responsible for the reproduction process. [This information is also presented in *Nature, Lond.*, 177, 4511, pp. 702–703, 1956.]

STARLINGER (P.). **Vergleich der serologischen Spezifität des Tabakmosaikvirus mit nucleinsäure-freien und- haltigen Abbauprodukten des Virus.** [Comparison of the serological specificity of Tobacco mosaic virus with breakdown products of the virus free from or containing nucleic acid.]—*Z. Naturf.*, 10 b, 6, pp. 339–343, 1955.

The serological differences between tobacco mosaic virus itself and its cleavage products, free from or containing nucleic acid, were examined at the Max Planck Institute for Virus Research, Tübingen, Germany [see preceding abstracts]. Pure nucleic acid did not react with an anti-tobacco mosaic serum. It is concluded that the linkage of the nucleic acid to the virus protein alters the structure of the latter, the change being apparent not only in its serological behaviour but also in the insolubility of the nucleic acid-free protein at 37° C.

BERCKS (R.) with the collaboration of GERTRUD QUERFURTH. **Über Konzentration und Verhalten des X-Virus in alten Blättern.** [On the concentration and behaviour of the X-virus in old leaves.]—*Phytopath. Z.*, 26, 1, pp. 35–40, 1 fig., 1 graph, 1956.

Samsun tobacco plants inoculated at the four-leaf stage with potato virus X at the Institute for Virus Serology, Brunswick, Germany, were examined periodically by serological and electron-microscopic methods for their virus content [cf. *R.A.M.*, 35, p. 240]. As in previous observations [34, p. 187], the concentration was relatively high in the middle leaves and very low in the oldest ones. With advancing age (the last measurements were made 99 days after inoculation) the virus content of the middle leaves also declined.

The virus particles present in the middle leaves 50 to 60 days after inoculation were predominantly of normal length (500 mμ) [35, p. 118], while the older foliage contained mostly fractions, at most half the length of the whole ones. At a later stage fractions constituted the bulk of the virus content of the middle leaves too.

It is apparent from these findings that potato virus X tends strongly to disintegrate in the older leaves of plants grown under normal conditions, although fractions were barely detectable in preparations made by the water-pressure method [loc. cit.]. In decapitated plants the virus content even of old leaves was composed largely of entire particles. The examination of plants that had formed lateral shoots yielded ambiguous results, but here, too, the saps of older leaves frequently contained a considerable number of normal-sized elements.

Adsuar (J.) & Pérez (J. E.). **Cross-protection tests confirm the presence of etch virus on Tobacco in Puerto Rico.**—*J. Agric. Univ. P.R.*, 40, 1, pp. 83–84, 1 fig., 1956.

During a recent survey of the viruses present in tobacco in Puerto Rico, one field sample produced etch symptoms in tobacco plants inoculated in the laboratory and typical necrotic primary lesions in *Chenopodium album* and *Physalis peruviana*. The identity of the virus, a severe strain of tobacco etch [*R.A.M.*, 22, p. 227], was confirmed by serological experiments and by cross-protection tests on *P. peruviana* previously inoculated with a mild strain.

Fulton (R. W.). **Curly-top of Tobacco in Wisconsin.**—*Plant Dis. Reptr*, 39, 11, pp. 799–800, 1955. [Photo-offset.]

In July, 1954, a disease not previously noticed was observed in many tobacco fields in both tobacco-growing areas of Wisconsin. The affected plants suddenly stopped growing and the edges and tips of immature leaves curled under and puckered. The fully expanded leaves yellowed and died a few weeks later. Most of the infection occurred early in the month and many of the infected plants died by the end of August. The disease was readily transmitted by grafting to tobacco, *Nicotiana rustica*, *N. glutinosa*, tomato, petunia, and *Datura stramonium*. Under greenhouse conditions at 75° F. during the winter only a few infected [? tobacco] plants died and most of the graft-inoculated ones recovered two to three weeks after the appearance of acute symptoms. Since transmissions were obtained with the beet leafhopper [*Eutettix tenella*: *R.A.M.*, 33, p. 698] the agent of the disease was identified as sugar beet curly top virus [cf. 35, p. 339].

Braun (A. C.). **A study on the mode of action of the wildfire toxin.**—*Phytopathology*, 45, 12, pp. 659–664, 1 fig., 2 diags., 1 graph, 1955.

The information in this paper on the biological activity of the toxin from the tobacco wildfire bacterium (*Pseudomonas tabacum*) as a function of methionine, its structural analogue, has already been presented from another source [*R.A.M.*, 35, p. 240].

Segall (R. H.) & López-Matos (L.). **Control of damping-off of Tobacco in seedbeds by the use of gaseous soil fumigants.**—*J. Agric. Univ. P.R.*, 40, 1, pp. 62–66, 1956. [Spanish summary.]

Experiments at the Agricultural Experiment Station, University of Puerto Rico, Río Piedras, demonstrated that a single application before seeding of the soil fumigants methyl bromide and chloropicrin aerosol at 2 or 4 lb. per 100 sq. ft. controlled damping-off in tobacco seed-beds more effectively than the fungicides previously recommended [*R.A.M.*, 33, p. 452] and resulted in higher emergence. After emergence the seedlings were drenched at weekly intervals for six weeks with 2 lb. per 100 gals. copper oxychloride at 6 gals. per 100 sq. ft. Although fumigation is more expensive than the application of fungicidal drenches, chiefly owing to the equipment required, it may still be economically practicable as the herbicidal properties of the fumigants render hand-weeding unnecessary.

Ragheb (H. S.) & Fabian (F. W.). **Growth and pectolytic activity of some Tomato molds at different pH levels.**—*Food Res.*, 20, 6, pp. 614–625, 3 graphs, 1955.

At the Department of Microbiology and Public Health, Michigan State University, 25 moulds isolated from Indiana and Ohio tomatoes in 1953 were examined for growth and pectolytic activity in canned tomato juice (determined by measuring the percentage loss in viscosity) at pH levels ranging from 2 to 10·8.

No mycelial mat formation occurred at the two extremes and only five species were slightly active at pH 2, viz., *Aspergillus niger*, *A. terreus*, *Botrytis cinerea*, *Colletotrichum phomoides*, and *Rhizoctonia* [*Corticium*] *solani*; the optimum

hydrogen-ion concentrations for the growth of the above-mentioned species were 3 to 6, 4·5, 4·5, 3 to 6, and 6, respectively. In none of these or in *Fusarium oxysporum*, *Mucor globosus* No. 77, *Penicillium oxalicum* (Nos. 111 and 116), *P. purpurogenum* (No. 113), *Rhizopus nigricans* [*R. stolonifer*] (Nos. 154 and 166), or *Trichoderma lignorum* [*T. viride*] was there any correlation between the amount of growth and pectolytic activity, but in *F. cephalosporium*, *M. globosus* (No. 83), *M. hiemalis* (Nos. 73 and 74), *Oospora* sp. (Nos. 94 and 98), and *P. purpurogenum* (No. 119) pectolysis decreased with a decline in growth.

Diener (U. L.). **Host-penetration and pathological histology in gray leaf spot of Tomato.**—*Phytopathology*, 45, 12, pp. 654–658, 5 figs., 1955.

Continuing his studies on *Stemphylium solani* at North Carolina State College [*R.A.M.*, 34, p. 679], the author found that the tomato leaf is invaded primarily through the stomata by means of an infection peg or the germ-tube tip, although direct penetration also occurs and is effected by the entrance of infection pegs between epidermal cells or between the outer guard-cell wall and the adjacent epidermal cell.

In the leaf tissue the fungus developed in the same way irrespective of the mode of penetration, bulbous primary hyphae arising from the infection hyphae in the substomatal or subepidermal cavities within 24 hours of inoculation. The secondary hyphae branched intercellularly, and at the end of 48 hours after inoculation their development was already extensive, while after 60 hours the host cell protoplasts in the lesion were apparently disorganized and a dense granular material could be observed. Cellular disintegration proceeded in the immediate vicinity of the invading hyphae, the cell walls in advance of which were perceptibly altered. Peripheral growth of the fungus did not seem to continue in the later stages of infection.

John (C. A.) & Sova (C.). **Incidence of Tobacco mosaic virus on Tomato seed.**—*Phytopathology*, 45, 11, pp. 636–637, 1955.

In a study undertaken to ascertain the source of infection of tomato by tobacco mosaic in Ohio [*R.A.M.*, 32, p. 403] *Nicotiana glutinosa* plants at the four- to eight-leaf stage were inoculated with an extract of crushed tomato seed, rinsed with distilled water, and maintained at a temperature of or above 80° F.; lesions appeared in 36 to 48 hours.

In assays made in 1953 the virus was detected on lots of three varieties of seed saved during 1950, 1951, and 1952 and held in bags in common storage. During this period there was apparently little loss of infectivity. The virus on small samples of Rutgers Regular and Rutgers Nursery seed removed from the large bags and stored in paper envelopes in the laboratory, however, was inactivated after seven months. The more rapid loss of infectivity in the laboratory as compared with common storage is attributed to the greater exposure to air in the envelopes than in the bags.

Brock's finding that trisodium phosphate inactivates the virus [32, p. 61] was confirmed in tests on Rutgers Regular, which was treated with a 10 per cent. solution for 15 minutes. Repeated germination tests in soil showed no reduction in viability for treatment periods up to and including four hours (two in the case of a 20 per cent. solution); prolonged exposure resulted in reductions of emergence ranging from 5 to 30 per cent.

Some water extracts of popular brands of cigarettes and cigars contained tobacco mosaic virus and some did not [cf. 34, p. 189].

Roll-Hansen (J.) & Vibstad (A.). **Veksthustomat på Kvithamar 1952–1953. Forsøk med sorter, damping og behandling med magnesiumsulfat.** [Glasshouse Tomatoes at Kvithamar 1952–1953. Experiments with varieties, steaming,

and treatment with magnesium sulphate.]—Reprinted from *Gartneryrket, 1954*, 11, 10 pp., 1954. [Received 1956.]

From the economic standpoint there was little difference between the tomato varieties Kvithamar, Potentate, and Selandia in productivity trials at the State Experiment Station, Kvithamar, Norway, in 1952–3. The cultivation of Kvithamar is recommended where outbreaks of leaf mould [*Cladosporium fulvum*] are to be anticipated, since it is resistant to physiologic race A of the fungus, the only one hitherto encountered in the country. This variety is, however, subject to magnesium deficiency [*R.A.M.*, 27, pp. 49, 341, *et passim*], which was controlled by five applications of a 2 per cent. magnesium sulphate solution plus a sticker (triton), resulting in a yield increase of 11·7 to 12·6 kg. per sq. m. (8 per cent.).

Steam sterilization of the soil against cork [brown root] rot [? *Cylindrocarpon radicicola*: 34, p. 485] in December, 1951, produced increases of 42 and 42·5 per cent. in 1952 and 1953, respectively.

Schmidt (H. A.). **Versuche zur Bekämpfung der Phytophthora an Tomaten.** [Experiments on the control of *Phytophthora* on Tomatoes.]—*NachrBl. dtsch. PflSchDienst, Berl.*, N.F., 9, 4, pp. 67–73, 1 diag., 1955.

Not only the potato but also the tomato crop sustains heavy damage in the coastal areas of Mecklenburg, Germany, from *Phytophthora* [*infestans*: *R.A.M.*, 31, p. 584; 35, p. 401], the latter mainly in the form of a brown fruit rot. In preliminary spraying experiments in 1953 on the Bonny Best variety at the Rostock branch of the Biological Institute, 1 per cent. cupral (a Bordeaux mixture containing 16 per cent. copper) proved greatly superior to 0·1 per cent. ceresan-liquid and 0·75 per cent. fuclasin F in the control of the disease. In 1954 only cupral (0·5 and 0·1 per cent. of the preparations containing 16 and 45 per cent. copper, respectively), was applied to the Frühe Liebe, Rheinlands Ruhm, and Vortreffliche varieties on dates determined beforehand according to (*a*) Thran's 'meteorological periods' cited by Uhlig [34, p. 393] and (*b*) 'calendar periods' based on several years' local observations of the critical times for blight epiphytotics. The former method of calculation necessitated three and the latter four treatments.

Brown rot was observed on Frühe Liebe tomato fruits on 8th August, on Vortreffliche on the 11th, and on Rheinlands Ruhm on the 14th, the outbreak being at a climax from the end of August to the end of September. The disease had already appeared on Frühmölle potatoes on 4th August. The early-maturing Frühe Liebe was the least severely attacked, the other two varieties, which ripen about the time infection reaches a peak, showing a high proportion of rotted fruits.

The applicability of Thran's forecasting method to the Mecklenburg coastal region cannot be judged by the results of this single trial, in which, moreover, operations were greatly hampered by the heavy rains which began in July. It would seem, however, that the two days estimated by Thran to be necessary for the development of an outbreak under the critical conditions defined [loc. cit.] may be reduced to one day.

The results of the experiments demonstrated the virtual impossibility of securing a healthy tomato crop without the application of copper-lime sprays. It is recommended that a prophylactic treatment should be given during the first ten days of July and repeated two or three times at two- to three-weekly intervals.

All three varieties were rather severely attacked by *Didymella lycopersici* [19, p. 441], which was not controlled by the copper-lime treatments.

Sanwal (B. D.). **Investigations on the metabolism of Fusarium lycopersici Sacc. with the aid of radioactive carbon.**—*Phytopath. Z.*, 25, 4, pp. 333–384, 4 figs., 11 graphs, 1956. [German summary.]

In further studies at the Federal Institute of Technology, Zürich, Switzerland

[*R.A.M.*, 34, p. 553], a virulent strain of *Fusarium* [*bulbigenum* var.] *lycopersici*, producing large amounts of aerial mycelium on malt agar and highly pathogenic to tomato [35, p. 401 and next abstract], secreted smaller quantities of toxins on Richards's medium than did a non-pathogenic isolate forming little or no mycelium. However, when the glucose and nitrogen contents of the medium were reduced by half the normal to 2·5 and 0·5 per cent., respectively, toxin production by the virulent strain was more abundant than by the non-pathogenic.

With 2·5 per cent. glycine as the sole source of carbon, the fungus produced all its three known toxins, vasinfuscarin, fusarinic acid, and lycomarasmin. It can be tagged after five to eight days' growth in a medium containing 90 μC per ml. of 2-C^{14}-glycine, at which level of radioactivity some 40 per cent. of the cells are non-viable but virulence is not impaired. Inoculated into healthy tomato plants, the tagged mycelium secretes certain radioactive components which induce vein-clearing symptoms on the leaves and vascular browning of the stems. Substances secreted by both the pathogenic and non-pathogenic isolates include proteins (of which the former produces more than four times as much as the latter), amino acids, and sugars. Details are given of the changes undergone by fusarinic acid on its introduction into tomato cuttings at the minimal dose of 150 mg. per kg. fresh weight. At 200 mg. per kg. some 77 per cent. of the compound is metabolized by the host cells as compared with 93 per cent. at 100 mg., the difference probably being the residue in excess of the quantity required to produce disease. It is postulated that the injury caused by fusarinic acid may result from its conversion into more toxic substances within the host.

Gäumann (E.) & Naef-Roth (St[ephi]). **Über die chelierende Wirkung einiger Welketoxine. IV. Die Verschiebungen der Toxizität durch steigende Absättigung mit verschiedenen Schwermetallionen.** [On the chelating action of some wilt toxins. IV. Alterations in toxicity by increasing saturation with various heavy metal ions.]—*Phytopath. Z.*, 25, 4, pp. 418–444, 1 fig., 3 graphs, 1956. [English summary.]

In further studies on tomato wilt [*Fusarium bulbigenum* var. *lycopersici*] in the current series [see preceding abstract] increasing concentrations of magnesium, manganese, iron, cobalt, nickel, or copper ions were added to the toxins komplexon III or lycomarasmin before their introduction into tomato shoots. The strength of the bonds between the ions and the toxins on the one hand and the injury caused by the former on the other determined the pathogenic effect.

The toxicity of the toxins was not affected by an accumulation of magnesium (the weakest complex-producer), the ions evidently being released immediately within the cell but causing no damage. The capacity of manganese to form co-ordinative linkages suffices for the detoxication of a strong chelating agent like komplexon III down to 61 per cent. of its natural toxicity, but not of lycomarasmin, a weak chelating agent; the manganese ions are liberated at once but do not injure the cells. The linkages of cobalt, nickel, and copper are strong and their complexes remain stable in the host cells; both chelating agents, therefore, are detoxicated by increasing concentrations of these three ions, the maximum inhibition occurring at equimolecular saturation of the toxins. For the complexes of lycomarasmin with cobalt, nickel, and copper the minima of the injury curves lie at 38, 34, and 18 per cent. detoxication, respectively.

In so far as komplexon III and lycomarasmin damage tomato plants in their capacity as chelating agents, the critical range of injury lies in the iron sector which occupies an intermediate position in respect of its aptitude for complex formation, on the one hand, and its toxicity to the plants on the other. Its complexes disintegrate within the cells as readily as those of magnesium and manganese, while it is as toxic to the cuttings as cobalt, nickel, and copper.

The pathogenic action of lycomarasmin in relation to iron is ambivalent, in part producing deficiency symptoms due to the withdrawal of iron and in part through the liberation of the chelated iron at 'wrong' places. The low stability of the lycomarasmin-iron complex is due, not only to the relatively slight capacity for complex formation of both partners, but more especially to its photosensitivity, decomposition accelerating in light. The consequent alternation of the photoreduction and reoxidation of the iron complexes with lycomarasmin and komplexon III culminates in the production of iron hydroxide within the cell.

Report on forest research for the year ended March, 1955.—140 pp., 12 pl., 8 figs., London, H.M. Stationery Office, 1956.

In the forest pathology section (pp. 52–57) of this report [cf. *R.A.M.*, 32, p. 107] T. R. Peace and J. S. Murray state that *Lophodermium macrosporum* [cf. 33, p. 456], newly recorded in Scotland, was associated with severe browning of Sitka spruce [*Picea sitchensis*] seedlings. *Rhizosphaera kalkoffi* [cf. 28, p. 40] on Norway spruce [*P. abies*] is now regarded as a secondary parasite.

In Glentress Forest and in an experiment in the Forest of Dean moderately severe attacks of *Rhabdocline pseudotsugae* [27, p. 505] developed on Douglas fir [*Pseudotsuga taxifolia*] provenances from both coastal and inland sites. Hitherto coastal *P. taxifolia* has been considered immune from this disease, which will need re-evaluation with reference to race relationships. An outbreak of die-back in Corsican pine [*Pinus nigra* var. *calabrica*] near Killin, Scotland, was due primarily to *Brunchorstia destruens* [32, p. 107] rather than climatic unsuitability. The humid weather of the summer of 1954 was a contributory factor to an increase in local epidemics of *L. pinastri* [32, p. 108] on Scots pine [*P. sylvestris*].

Three more *Thuja plicata* nurseries have become infected with *Keithia* [*Didymascella*] *thujina* [loc. cit.]; in one, infection was traced to the accidental importation of diseased material, but the source of infection in the other two is unknown

Meria laricis [31, p. 91] appeared on Japanese larch [*Larix leptolepis*] in nurseries in south-east Scotland and Cornwall, and on (?) hybrid larch in North Wales.

In fungicide trials against *Botrytis cinerea* inoculated on seedling Sitka spruce, *Pseudotsuga taxifolia*, *Sequoia sempervirens*, and *Cupressus macrocarpa*, one application of an unspecified fungicide was inadequate for control. The necessity for more work on this disease was emphasized by the occurrence of a severe attack on Sitka spruce seedlings in a nursery in Fife, following autumn frost and subsequent snow in 1954.

The incidence of *Nectria ditissima* [32, p. 347] on young beech in Westbury Forest, Hampshire, is declining. In many instances cankers were formed following mechanical damage caused by insects or honeysuckle, and once infection was established the fungus spread without further aid.

In the section of the report devoted to research undertaken for the Forestry Commission by workers attached to universities and other institutions D. M. Griffin (pp. 75–76) describes work at the University of Cambridge on fungal damage to roots of seedlings in forest nurseries. Observations in seven nurseries during 1954 established that *Pythium* spp., primarily *P. ultimum* and *P. debaryanum*, are the main pathogens. Damage in sample plots was assessed from 20 seedlings, the number killed of 20 root tips of each was noted and the average damage per plot calculated. Results were consistent both for different samples from the same plot and for different workers assessing the same sample. Root damage was found to be quite insufficient for the primary cause of stunting; the difference in size between seedlings grown on sterilized and partially sterilized plots was not attributable to the action of root-killing fungi.

At Bedford College, London, I[da] Levisohn (pp. 76–77) carried out pot experi-

ments with pines, Norway spruce, and birch to determine the rhizosphere effect of *Boletus scaber* [34, p. 802; 35, p. 315] on shoot development before mycorrhizal formation takes place. During the first year of growth the pine species showed no effect. There was an improvement in foliage colour of Norway spruce in inoculated cultures and an increase in shoot development in birch, as well as an improvement in leaf size and colour. Birch seedlings grown in heathland soil plus compost and inoculated with *B. scaber* grew 8·8 in. (average 13 plants) in one growing season, compared with 7·7 in. (average 14 plants) in the uninoculated controls; with a third of the amount of compost the corresponding figures were 6·1 in. (16 plants) and 5·1 in. (14 plants). At the time of assessment *B. scaber* had not formed an association with the seedlings.

In further experiments, using *Robinia pseudoacacia* as the test plant, the rhizosphere effect produced on an endotrophic plant by an ectotrophic mycelium was demonstrated with *B. scaber* [35, p. 478]. The controls received a dose of nutrient medium equivalent to that introduced in the inoculated series. At the end of the first season the controls averaged 2·3 in. growth and those inoculated with *B. scaber* 3·4 in. No trace of nodule or mycorrhizal infection was observed in any of the cultures.

Researches for a number of years have shown that the activity of mycorrhizal fungi induces forking in the short roots of pines without an association being formed. When larch and Sitka and Norway spruces were grown in similar experiments the same phenomenon was observed. Root systems in sterilized soil showed a complete absence of short roots while those of seedlings grown in the leaching water of the same soil, but inoculated with mycorrhiza-formers, developed a prolific amount of short roots. *B. scaber* proved to be a suitable fungus for this work, growing readily on all the common culture media, sterilized soils, and in liquid media. However, it is relatively slow in producing mycorrhizal infection, and was shown in both pot-culture and in the field to inhibit mycorrhizal formation by *B. bovinus*. It also delays or inhibits the development of other mycorrhizal fungi.

Studies on the relationships between larch canker and *Trichoscyphella willkommii* were continued by J. G. Manners (pp. 78–79) at the Department of Botany, Southampton University [34, p. 6]. In inoculation tests with *T. willkommii* in a frost-free locality all the histological abnormalities associated with natural cankers were reproduced, with the exception of frost rings. Trees inoculated in 1953 still bore unhealed, though not very active, cankers in March, 1955. Cankers were produced under experimental conditions by projecting a cold air stream on the bark of potted larches. The cankers so induced were anatomically similar to those produced by inoculation with *T. willkommii* in the absence of frost, excepting for the absence of fungus mycelium in the former.

Bekæmpelse af svampe. [Control of fungi.]—*Forstl. Lommehaandb., 1955*, pp. 9–14, 1955.

The 'Silvicultural Pocket Handbook' for 1955 contains, *inter alia*, the following directions for the control of fungi on trees and forest products in Denmark. Oak mildew [*Microsphaera alphitoides*] may be combated either by spraying with 3 per cent. lime-sulphur or dusting with sulphur, the first application to be made as the leaves are unfolding and thereafter at repeated intervals.

Damping-off of beech [cf. *R.A.M.*, 32, p. 347] is amenable to two treatments with 2 per cent. Bordeaux or 2 per cent. Burgundy mixture, the first at the end of May and the second two to three weeks later, using 100 to 150 l. per ha. Bordeaux dust may be substituted for the liquid, in which case the first treatment should be followed by two to three more at weekly to fortnightly intervals, using 5 to 6 kg. per ha. for each.

Two applications of 2 per cent. Bordeaux mixture are also effective against

needle-cast of pine (*Lophodermium* [*pinastri*: cf. below, p. 562]), the first during the latter part of July and the second at the end of August. The mixture should be supplemented by a sticker of 0·2 to 0·5 per cent. resin soap or 5 per cent. skim milk. If the dust is used it should be applied fortnightly in July and August.

Birch rust [*Melampsoridium betulinum*] is also controllable by Bordeaux mixture, either liquid (2 per cent.) or dry, an application immediately after the trees come into leaf being followed by one or more during the summer. Lime-sulphur (10 per cent.) may also be used, but not after bud burst on account of its tendency to scorch.

Bordeaux mixture is further recommended for the treatment of 'constriction disease' [of unspecified origin] of Douglas fir [*Pseudotsuga taxifolia*], to be applied about 1st March and 1st October. It may also be used, as a 2 per cent. spray, against [unspecified] poplar canker, several treatments being given during the summer following an initial application just after the trees come into leaf. This schedule may be supplemented by two lime-sulphur sprays, one immediately after leaf fall in October and the other in March at the end of dormancy. Instructions are given for soil sterilization against damping-off [of undetermined origin] with formalin, mercuric chloride, and other mercurials; treatment of acorns by dusting with tillantin 1875 at 300 gm. per 100 kg. (five minutes in a rotating drum), and of other seeds by immersion for half-an-hour to one hour in an aqueous mercurial solution, e.g., of tillantin, germisan, or sanagran; impregnation of spruce fence stakes with 5 per cent. copper sulphate; preservation of beech billets by treatment of the ends and cut surfaces with 'Junckers beech grease' or some other commercial preparation, e.g., 'Bayer Buchenschutz', or by immersion in or sprinkling with water at the sawmill.

In a concluding section information is presented on the composition, preparation, and uses of a number of fungicides against tree diseases.

Khan (A. H.). **Some of the hardwood and coniferous rusts on the forest and avenue trees of Pakistan.**—*Pakist. J. For.*, 4, 4, pp. 261–270, 3 figs., 1954.

The writer lists the rusts recorded on conifers and hardwoods in Pakistan, with their tree hosts, and for some of those on conifers, their alternate hosts. Of interest on hardwoods are *Olivea tectonae* [*R.A.M.*, 31, p. 214] on teak, *Uredo sissoo*, which attacks young leaves of *Dalbergia sissoo*, *Mainsia pterocarpi* [26, p. 470] on *Pterocarpus marsupium*, and *Melampsora aecidioides* [25, p. 145] on *Populus alba*. Rusts on conifers worthy of note are *Cronartium himalayense* [13, p. 340] on *Pinus longifolia*, *C. ribicola* [31, p. 410] on *P. excelsa*, and *Peridermium cedri* [32, p. 158] on deodar [*Cedrus deodara*].

Chestnut blight and resistant Chestnuts.—*Fmrs' Bull. U.S. Dep. Agric.* 2068, 21 pp., 11 figs., 2 maps, 1954.

This bulletin by the Fruit and Nut Crops and Diseases section of the Horticultural Crops Research Branch, United States Department of Agriculture, replaces an earlier publication [cf. *R.A.M.*, 10, p. 276]. The spread of chestnut blight (*Endothia parasitica*) during the last 20 years is described, and an account is given of the behaviour of the varieties of chestnut that are resistant in varying degree, and of the attempts to breed blight-resistant forms [34, p. 113]. Particulars are given concerning the care and management of the Chinese chestnut (*Castanea mollissima*), the most successful of the resistant Asiatic chestnuts.

Boyce (J. S.). **Spraying logs of Oak wilt trees to reduce infection hazard.**—*Res. Notes Stheast. For. Exp. Sta.* 52, 2 pp., 1954. [Mimeographed.]

In 1952 and 1953 trials were carried out in western North Carolina and eastern Tennessee of the chemical treatment of oak trees infected by *Endoconidiophora*

fagacearum [*Chalara quercina*: [*R.A.M.*, 35, p. 403] to reduce the possibility of the spread of the disease from them by insects [see following abstracts]. Unbarked logs cut in summer were sprayed with a mixture of 1 per cent. DDT and 5 per cent. pentachlorophenol in No. 2 fuel oil. Two months later sample areas of bark were peeled back, the fungus mats examined, and surviving insects counted. In 1952 there were 2·9 living insects per sq. ft. of mat on the sprayed logs and 105 on the unsprayed; in 1953 the figures were 16 and 127. Pentachlorophenol inhibited fungus growth on the ends of the logs but had no effect on mat formation beneath the bark.

Stambaugh (W. J.), Fergus (C. L.), Craighead (F. C.), & Thompson (H. E.). **Viable spores of Endoconidiophora fagacearum from bark and wood-borne beetles.**—*Plant Dis. Reptr*, 39, 11, pp. 867–871, 1955. [Photo-offset.]

In studies conducted by the Department of Botany and Plant Pathology, Pennsylvania State University, University Park, and Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, a modification of F. F. Jewell's method of spermatization [*R.A.M.*, 33, p. 454] was used to determine the presence of spores of oak wilt (*Endoconidiophora fagacearum*) [*Chalara quercina*: see preceding and following abstracts]. The insects were macerated in water and the suspension applied to colonies of both compatibility types. The bark and wood-boring beetles, *Agrilus bilineatus*, *Xyleborus* spp. [cf. 29, p. 302], *Xyleterinus politus*, and *Pseudopityophthorus* spp. [34, p. 192] were found to carry viable spores from diseased tree parts. Since they have not been observed to feed on mycelial mats these insects presumably obtain inoculum from the sapwood. Their activities may explain cases recently observed in Pennsylvania of the spread of the disease some 50 to 150 ft. beyond the nearest known infected tree.

Jones (T. W.) & Bretz (T. W.). **Radial penetration of the Oak-wilt fungus into the boles of diseased trees.**—*Plant Dis. Reptr*, 39, 11, p. 872, 1955. [Photo-offset.]

Isolations from borings made in standing oak trees killed by wilt (*Endoconidiophora fagacearum*) [*Chalara quercina*: see preceding and next abstracts] in southern Missouri indicated that by the time mycelial mats are produced the fungus may have invaded any part of the sapwood [cf. *R.A.M.*, 27, p. 165; 28, p. 552].

Himelick (E. B.) & Curl (E. A.). **Experimental transmission of the Oak wilt fungus by caged squirrels.**—*Phytopathology*, 45, 11, pp. 581–584, 1 fig., 1955.

An increase in the feeding by rodents (probably squirrels) on mycelial mats of *Endoconidiophora fagacearum* [*Chalara quercina*: see preceding abstracts] was indicated by field observations during 1953–4 in Illinois [*R.A.M.*, 32, p. 597]. Grey and fox squirrels (*Sciurus carolinensis* and *S. niger*) were caged with potted three-year-old healthy oaks (*Quercus borealis*), given food contaminated by the fungus, and left to wound the trees at will. None of the 89 out of 209 trees damaged by gnawing developed wilt symptoms, nor was the pathogen isolated from them. In a greenhouse trial the same two species were fed on inoculum consisting of conidia, with or without ascospores, smeared on apple, and of conidium-bearing mats on oak bolts. Of the 61 trees damaged by squirrels after feeding on conidia alone, 20 wilted and died (33 per cent.), the corresponding figures for conidia and ascospores and for conidium-bearing mats being 28 out of 75 and six out of 18 (33), respectively. The caged animals transmitted the fungus to healthy potted oaks for intervals up to 12 hours after feeding on artificial inoculum and for a period of one hour when naturally occurring mycelial mats were used.

The combined results of field observations and greenhouse trials provide strong circumstantial evidence that squirrels may occasionally transmit *C. quercina*. Creosote, used either at full strength or diluted to three-quarters with paraffin, was the only one of several spray materials tested for their repellent properties that prevented squirrels feeding on the subcortical mats.

Davidson (R. W.) & Cash (Edith K.). **A Cenangium associated with sooty-bark canker of Aspen.**—*Phytopathology*, 46, 1, pp. 34–36, 2 figs., 1956.

A previously undescribed canker of aspen (*Populus tremuloides*) is reported from the central Rocky Mountains, where it is specially prevalent on the western slope of the Continental Divide in Colorado. Sooty-bark canker, as it is tentatively designated, occurs mainly in mature (60- to 80-year-old) and over-mature (80 to 150) stands at any point up to a height of 60 or 70 ft. The cankers may attain a length of 10 to 15 ft. on large trunks before girdling the tree. The bark turns black and remains intact over the cankered area. The fungus appears to cement the cortex to the trunk, producing a characteristic pattern on the wood that is exposed after the bark finally weathers off. After three to five years the pale grey, discoid or urn-shaped apothecia of *Cenangium singulare* (Rehm) n.comb. (syn. *C. populneum* var. *singulare* Rehm and *C. pruinosum* (Ell. & Ev.) Seaver which is antedated by *C. pruinosum* Ces.) [*R.A.M.*, 31, p. 460] develop in profusion on the old, blackened bark or below the loosened white surface layer.

Taris (B.). **Résistance au froid du mycélium de Dothichiza populea Sacc. et Briand et de Cytospora chrysosperma (Pers.) Fr.** [Resistance to cold of the mycelium of *Dothichiza populea* Sacc. & Briand and *Cytospora chrysosperma* (Pers.) Fr.]—*C. R. Acad Sci., Paris*, 242, 12, pp. 1648–1649, 1956.

In connexion with studies on the seasonal rhythm of proliferation of the mycelia of *Dothichiza populea* [*R.A.M.*, 10, p. 417] and *Cytospora chrysosperma* [*Valsa sordida*: 19, p. 623; 35, p. 249, *et passim*], isolates from poplar branches collected near Noyon, France, were subjected for periods of up to ten days to temperatures ranging from −11° to −35° C. Returned to the laboratory (18°) both species made normal growth (1 to 3 mm. daily for *D. populea* and 10 to 15 mm. for *V. sordida*) and were inoculated into their original host in the open with positive results.

Van den Ende (G.). **Verslag van het onderzoek naar de Populierenkanker in 1952 en 1953, veroorzaakt door Pseudomonas syringae v. Hall f. sp. populea Sabet.** [Report of the investigation in 1952 and 1953 on the Poplar canker caused by *Pseudomonas syringae* v. Hall f.sp. *populea* Sabet.]—*Meded. ned. Heidemaatsch.* 21, 19 pp., 2 figs., 1955. [English summary.]

Only two species of poplar out of the standard assortment of ten proved susceptible to *Pseudomonas syringae* f.sp. *populea* in further inoculation experiments during 1952 at the Willie Commelin Scholten Phytopathological Laboratory, Baarn, Holland [*R.A.M.*, 30, p. 293; 32, p. 458], viz., *Populus brabantica* and *P. candicans*, the others being field-resistant (*P. marilandica* moderately so). In 1953, however, the supposedly resistant *P. gelrica*, *P. serotina*, and two out of three selections of its var. *erecta* were more or less susceptible, possibly on account of the high mean temperature during December (5·4° C. as compared with 1·8° in 1952), which favoured continued growth by the pathogen. From a table giving the results of inoculation tests on 45 species and hybrids from 1950 to 1953, inclusive, it appears that *P. regenerata* (Kew) was resistant in all four years. *P. nigra* (Kew) was resistant from 1951 to 1953 (not tested in 1950), while the same species from Bennekom was moderately resistant in the first two and resistant in the last two years of the trials.

Promising results were given by crosses in which *P. nigra* or its var. *italica* served as one of the parents. Within the *leuce* and *aigeiros* groups resistance was introduced by the use of *P. tremula* and *P. marilandica*, respectively, as mother trees.

The reactions of imported clones were studied at Wageningen, where the 'spotted, quick-growing' 50 German selection, Italie No. 262 1947, and *P. regenerata* Neeroeteren were resistant from 1951 to 1953, inclusive. Of a number of *P. deltoides* clones from the Mississippi Valley inoculated in 1953, only those from Iowa and Missouri were susceptible.

Cristinzio (M.) & Verneau (R.). **L'eziologia del 'mal nero' del Noce in Campania.** [The etiology of 'black disease' of Walnut in Campania.]—*Ric. fitop. Campan.*, 12, pp. 3–34, 1 pl., 9 figs., 1954. [English summary.]

'Black disease' of walnut has grown in intensity in Campania, Italy, particularly in the provinces of Naples and Salerno, so that the crop as a whole, and the cultivation of local varieties in particular, is seriously endangered. A study of the disease was undertaken in view of its importance and the fact that it appeared to differ somewhat in symptoms and distribution from chestnut ink disease, hitherto believed to have a common agent (*Phytophthora cambivora*) [*R.A.M.*, 32, p. 106].

Diseased walnut samples collected from various localities from 1949 to 1952 yielded only six isolates, all identified as *P. cactorum* [34, p. 758]. Chestnut seedlings were infected successfully by inoculating the cambium with culture fragments of *P. cactorum* from walnut. Few oospores but numerous chlamydospores were found in the tissues. Those inoculated with *P. cambivora* yielded mycelium only. Symptoms also developed on six- to ten-year-old walnut trees inoculated with *P. cactorum* in the field but the fungus was not reisolated though typical mycelium was present in the affected tissues. *P. cambivora* on chestnut would appear to be far less widespread than was originally thought. *P. cactorum* forms sexual organs readily and is able to withstand unfavourable environmental conditions, thus ensuring its establishment over a wide area and rendering control very difficult. At present the [? walnut] disease can be prevented only in the nursery by growing seedlings in areas where walnut has never been grown before or on thoroughly disinfected soil, the plants being watched carefully at all times.

Yamamoto (W.), Maeda (M.), & Oyasu (N.). **Studies on the speckled Bamboos caused by parasitic fungi. I. On the fuscous speckled bamboo or 'unmonchiku' of Phyllostachys nigra Mun. var. henonis Mak.**—*Sci. Rep. Hyogo Univ. Agric.* (*Agric.*), 1, 2, pp. 59–63, 9 figs., 1954. [Japanese, with English summary.]

The authors consider that the speckling of the bamboo *Phyllostachys nigra* var. *henonis* is not of hereditary origin, but is due to a fungus, *Astrosphaeriella fuscomaculans* Yamamoto n.sp., which is described. The fungus causes an irregularly elliptic speck, dark brown or with fine white stripes, on the culms, and the mycelium appears on the whole surface of the bamboo. The fungus grew on onion and potato decoctions and on Czapek's medium, but did not sporulate in culture; perithecia were found on rotted portions of the bamboo.

Stover (W. S.) & Toole (E. R.). **Sweetgum blight in Louisiana as determined by the Forest Survey.**—*Plant Dis. Reptr*, 39, 11, pp. 864–866, 1 map, 1955. [Photo-offset.]

A forest survey carried out in 1953 and 1954 showed that blight of sweet gum (*Liquidambar styraciflua*) is widespread in Louisiana [*R.A.M.*, 35, p. 55], an average of 8 per cent. of the good-tree volume being in trees with an important degree of blight. The highest proportion (from 8 to 11 per cent.) was found to be in trees 10 in. or more in diameter.

Zycha (H.). **Definition von Rindenbrand und Krebs bei Waldbäumen.** [Definition of 'Rindenbrand' and 'Krebs' in forest trees.]—*Meded. LandbHogesch., Wageningen*, 20, 3, pp. 411–418, 5 figs., 1955.

The author draws attention to the need for a clear and standard use of the terms 'Galle', 'Canker', 'Rindenbrand', and 'Baumkrebs' in the German literature. He would like 'Gallen' to correspond to 'galls' in English usage and cites examples. He rejects 'Canker' for German usage and would divide it into 'Rindenbrand' and 'Baumkrebs', the former to be used only for annual cankers where damage (of

whatever origin) is repaired in the following growing season by wound callus; for example, that caused by *Phomopsis pseudotsugae* on *Pseudotsuga taxifolia*, whereas 'Baumkrebs' would be restricted to perennial cankers, which grow with the succeeding years [cf. next abstract]. He cites *Dasyscypha* [*Trichoscyphella*] *willkommii* on larch, *Pseudomonas rimifaciens* [*P. syringae* f.sp. *populea*: *R.A.M.*, 32, p. 522 and above, p. 560] on poplar, and recurrent frost damage as agents of this type of canker.

Zycha (H.). **Eine Krebserkrankung der Sitka-Fichte (Picea sitchensis (Bong.) Carr.).** [A canker disease of the Sitka Spruce (*Picea sitchensis* (Bong.) Carr.).] —*Forstw. Zbl.*, 74, 9–10, pp. 293–304, 4 figs., 1955.

This account from the Institute for Forest Pathology, Hann.-Münden, of a perennial canker of 15- to 54-year-old Sitka spruces attributed to *Nectria cucurbitula* [*R.A.M.*, 31, p. 92] is the first definite record of the disease in Germany. A detailed analysis is given of the progress of infection in 17 cankers. Although the available material was insufficient to decide with certainty whether frost damage is the primary cause of canker development, the fact remains that frost rings were found exclusively in diseased trunks, where they were confined to the younger trees. Nearly all the cankers were found on the basal 5 ft. of the trunks, suggesting that deer might be responsible for initial damage affording entry for the fungus.

Hepting (G. H.). **Gum flow and pitch-soak in Virginia Pine following Fusarium inoculation.**—*Sta. Pap. Stheast. For. Exp. Sta.* 40, 9 pp., 3 figs., 1954. [Mimeographed.]

Experiments were carried out in North and South Carolina to determine the gum yield and amount of pitch-soaked wood produced by Virginia pines [*Pinus virginiana*] following the application of a spore suspension of *Fusarium lateritium* f. *pini* [cf. *R.A.M.*, 29, p. 188] to cuts made to induce turpentining streaks. In a small trial when trees were given a fresh cut extending round half the circumference every year the average total yield per tree over four seasons was 3,158 gm. In the first season the yield was 770 gm. and that from comparable uninfected trees each receiving 32 similar cuts, 526 gm. Infection induced pitch-soaking in the invaded wood, but not beyond it, and the extent of invasion was not considerable, the scars after three years' cutting being on an average only 14 in. long while tangential spread of the fungus was about 1 in. on either side of the cuts.

The author concludes that yields were not high enough to justify the use of inoculated Virginia pine for either turpentining or wood naval stores. However, as certain trees consistently yielded well above the average, the method might be profitably used on such trees if they could be vegetatively propagated.

Observation on untreated trees in the area of the trial revealed no increase in the incidence of *Fusarium* canker.

Martin (J. F.) & Gravatt (G. F.). **Saving White Pines by removing blister rust cankers.**—*Circ. U.S. Dep. Agric.* 948, 22 pp., 14 figs., 1 map, 1954.

In this circular, dealing with blister rust (*Cronartium ribicola*) on white pines [*Pinus strobus*: cf. *R.A.M.*, 35, pp. 335, 336], the writers point out that the saving of infected trees is dependent on the removal of cankers and also of the alternate *Ribes* host, and is only justified when aesthetic or forest values exceed the cost. They describe how cankers may be identified and excised. After their removal, painting the wound with shellac lessens the flow of pitch, and a proprietary tree paint must subsequently be applied.

Olberg (A.). **Über die Kiefernschütte Lophodermium pinastri Schrad.** [On Pine needle-cast, *Lophodermium pinastri* Schrad.]—*Forst- u. Holzw.*, 10, 15, pp. 307–308, 1955.

It would appear from an article by K. Rack in No. 11 of *Forst-u. Holzw.* for the

current year that information concerning needle-cast of pine (*Lophodermium pinastri*) is almost as meagre today as it was 20 or 30 years ago. On the basis of lengthy experience in the Hann.-Münden silvicultural district of Germany [*R.A.M.*, 32, pp. 49, 526] the author is in a position to amplify the available knowledge on certain aspects of the disease.

The weather prevailing during the autumn and winter, especially the former, exerts an important influence on the course of infection. A cold autumn, with early and persistent frost, obviously retards mycelial development and may thereby save the host, since needle-cast does not seem to be lethal (except to one-year-old nursery plants) unless the buds, particularly the terminal, are permeated by the mycelium before opening. Thus, if mild weather continues up to the end of December, the coldest spring will not avail to prevent heavy damage by the mycelium, already too far advanced for a check at this stage. Such were the conditions prevailing in 1954–5. The losses caused by *L. pinastri* after bud burst are increased by reduction in the normal water supply and therefore tend to be heavier in the semi-continental climate of eastern Germany, with its frequent and severe spring droughts, than in the north-west, where a spring drought is exceptional.

Brief directions are given for control by spraying with Bordeaux mixture (found to be unequalled for the purpose by any of the numerous other fungicides tested) and appropriate silvicultural measures, including the use of reasonably wide plots in clear-cut areas and sparse, broadcast sowing.

Meier (H.). **Über den Zellwandabbau durch Holzvermorschungspilze und die submikroskopische Struktur von Fichtentracheiden und Birkenholzfasern.** [On cell wall degradation by wood-rotting fungi and the submicroscopic structure of Spruce tracheids and Birch wood fibres.]—*Holz a. Roh- u. Werkst.*, 13, 9, pp. 323–338, 25 figs., 1 diag., 1955.

In this important study at the Federal Technical Institute, Zürich, Switzerland, sterilized specimens of birch and spruce were placed on malt agar cultures of *Merulius domesticus* [*M. lacrymans*], *Polyporus betulinus*, *Fomes pini*, *F. annosus*, *Polystictus versicolor*, and *Chaetomium globosum* and preparations from them examined under the polarization and electron microscopes after two to three months' maintenance at 20° to 25° C.

M. lacrymans and *P. betulinus* uniformly decomposed cellulose, leaving a lignin residue. *F. pini* decomposed all the lignin of the middle lamella and other layers before attacking the cellulose. *Polystictus versicolor* decomposed the cellulose and encrusting material from the lumen simultaneously. In spruce *F. annosus* decomposed both cellulose and lignin at almost the same time, whereas in birch lignin was the first to be disintegrated. Like the brown-rotting fungi, *C. globosum* [see below, p. 566] did not decompose lignin, but it differs from them in the very peculiar form of disorganization induced by the growth of the hyphae in the interior of the secondary wall instead of in the lumen, resulting in rhomboid cavities.

It is conjectured that in birch the microfibrils of the primary and tertiary walls and the outer layer of the secondary one consist in part of hemicelluloses, glucan-xylan (mannan) compounds, or some special form of cellulose with decay-resistant attributes. Further details are given of the structure and texture of spruce tracheids and birch fibres.

Diseases of Silver Fir (Abies pectinata).—*Entopath. News*, [3], 9, pp. 7–8, 1956. [Mimeographed.]

A brief account is given of the principal pathogens of *Abies pectinata* in Great Britain and Western Europe, drawn up from the literature. The cultivation of the tree in Great Britain has now been largely discontinued. It is fairly resistant to fungus diseases. The following fungi have been reported from the British Isles:

Fomes robustus (stem rot), *Rehmiellopsis bohemica* [cf. *R.A.M.*, 19, p. 627] (the most important disease, causing needle-cast and occasional death of shoots), and *Lophodermium nervisequum* [cf. 16, p. 563] (needle-cast).

WATERMAN (ALMA M.). **The relation of Valsa kunzei to cankers on conifers.**—*Phytopathology*, 45, 12, pp. 686–692, 3 figs., 1956.

At the Northeastern Forest Experiment Station, New Haven, Connecticut, the species of *Cytospora* prevalent on spruces [*R.A.M.*, 16, p. 648] and of the related *Valsa* state were studied in comparison with those of the same genera on other conifers [21, p. 106; 22, p. 1]. Pycnidia and perithecia from *Abies balsamea*, *Pseudotsuga menziesii* [*P. taxifolia*], larch (*Larix decidua*), *Tsuga canadensis*, spruces (*Picea abies*, *P. pungens*, *P. glauca*, *P. orientalis*, and *P. rubens*), and pines (*Pinus strobus* and *P. wallichiana*), and from pure cultures and sterilized twigs were studied. Pycnidial stromata were extremely variable on any one host, so the more constant perithecial characters were used for diagnosis.

The fungus on all the conifers was found to agree with *V. kunzei*, three varieties of which are described, with their corresponding pycnidial states, namely, var. *kunzei* n.var. (typical) on *A. balsamea*, *Pseudotsuga taxifolia*, larch, and *T. canadensis*; var. *piceae* n.var. on the five species of spruce listed above; and var. *superficialis* n.comb. (*C. superficialis* v. Höhn. in *Mitt. bot. Inst. tech. Hochsch. Wien* 3, pp. 5–15, 1928), reported by Baxter as *V. superficialis* on the two above-mentioned species of pine [*R.A.M.*, 17, p. 359].

V. kunzei var. *kunzei* agrees closely with the Latin diagnosis of *V. kunzei* in *Syll. fung.*, 1, p. 139, 1882, and *C. kunzei* var. *kunzei* n.var. with Saccardo's description of *C. kunzei* (3, p. 270, 1884). *V. kunzei* var. *piceae* differs from the type variety in the broader perithecial stromata and the poorly defined, irregular, marginal band of tissue. In cultures on Leonian's medium [*R.A.M.*, 3, p. 544] the pycnidial stromata of *C. k.* var. *kunzei* and *C. k.* var. *superficialis* n.comb. were comparatively small, fairly numerous, and white to grey or black with white hyphae at the top. On sterilized twigs both varieties produced pycnidial and perithecial stromata with the dark marginal zone line delimiting the two types of stromata characteristically situated in the cortex. The few but very large pycnidial stromata of *C. k.* var. *piceae* n.var. produced on both media were olivaceous to black. The dark brown marginal line was formed occasionally in the cortex just beneath the stromata. No perithecial stromata were formed.

Inoculation experiments were performed with pycnidia and mycelium of isolates of each of the three varieties on three species of spruce, *Pseudotsuga taxifolia*, *A. fraseri*, larch, and white pine. Positive results (canker formation) were obtained only with var. *piceae* on the spruces and in three tests on *P. taxifolia*.

Spraying with Bordeaux mixture 4–4–50 failed to control canker formation on ornamental spruces, and the more effective method of excision of infected bark is regarded as generally impracticable.

RØED (H.). **En brunsporet skivesopp (Flammula spumosa Fr.?) som årsak til rødråte i tremasse.** [A brown-spored agaric (*Flammula spumosa* Fr.?) as the cause of red rot in wood pulp.]—*Blyttia*, *1955*, 2, pp. 50–59, 5 figs., 1956. [English summary.]

Information already presented on blue stain and rotting of wood pulp in Norway [*R.A.M.*, 34, p. 761] is recapitulated, with special reference to *Flammula spumosa*, isolated from reddish-brown spots on the inner sheets of a bale. The pileus of the fruit bodies produced by paired uni- and binuclear mycelia, which gave rise to clamp-connexions in pure culture on potato dextrose and malt agars, measured up to 1·5 cm. in width and was of a pale yellow-brown to dark brown colour, with a light-tinted, usually upturned, slightly fringed edge. The oval basidiospores were

6·8 to 8·5 by 4 to 5, mostly 7·5 by 4·5 μ, and the cystidia irregularly flask-shaped or occasionally vesicular and pedicellate. The slight departures from the type in the form and colour of the pileus are attributed to cultural conditions, and the identity of the fungus with *F. spumosa* is regarded as reasonably assured.

Jørgensen (E.). **Trametesinfektion.** [*Trametes* infection.]—*Dansk Skovforen. Tidsskr.*, 39, 11, pp. 583–611, 3 figs., 1954.

Essential information is presented on the root rot of conifers caused by *Fomes annosus* (which also attacks hardwoods to a lesser extent) and the actual status of the problem in Denmark [*R.A.M.*, 31, p. 412; 34, p. 826] discussed in the light of 22 contributions to the literature on the subject.

Rattsjö (H.) & Rennerfelt (E.). **Värdeförlusten på virkesutbytet till följd av rödrota.** [Depreciation of saw timber in consequence of root rot.]—*Norrlands SkogsvFörb. Tidskr., 1955*, 3, pp. 279–298, 1 diag., 9 graphs, 1955. [English summary.]

During an investigation from 1952 to 1954 on sample plots of spruce, each covering 0·1 ha., in four districts of Värmland, Sweden, substantial depreciation was found to be caused by fungal root rots. *Fomes annosus* [*R.A.M.*, 33, p. 190] was the most important pathogen, being responsible for 82 per cent. of the entire damage, followed by *Armillaria mellea* (8), while other species, including *Trametes* [*F.*] *pini* and *Stereum sanguinolentum*, accounted for the remaining 10 per cent. The maximum financial loss from the rots was estimated at Kr. 3,000 per ha., or roughly 30 per cent. of the total value. The decay largely involves the most valuable part of the trunk, which must be either discarded altogether or sold for pulpwood at a reduced price.

Annual Report Forest Research Institute, 31 March 1955.—74 pp., New Zealand Forest Service, Wellington, 1955.

On pp. 58–59 of this report it is stated that examination of a one-acre sample plot of *Pinus radiata* in the Whakarewarewa Forest revealed that although *Armillaria mellea* [*R.A.M.*, 33, p. 328] was not significant as a parasitic root rot it had colonized 25 per cent. of the 398 dead trees and stumps, and was thus firmly established as a potential disease. In a smaller sample plot (0·4 acre *P. radiata*: natural regeneration) 23 per cent. of the 622 living trees were infected at the collar, but these were mainly confined to one-half of the plot, where 46 per cent. of the trees were attacked and one suppressed tree killed.

The 'GB' fungus, an unidentified root, butt, and stem rot fungus on *P. radiata* in the North Auckland plantations, was found to be more widespread than at first reported. A brief survey showed that it is active in previously undetected areas in the Waipoua, Waitangi, Puhipuhi, and Glenberrie forests and at Whangarei. Field observations suggest that the fungus is present in the planting areas as a root and stem rot of manuka (*Leptospermum scoparium*) before the pines are planted.

Henderson (F. Y.). **Report of the Director of Forest Products Research for the year 1954.**—*Rep. For. Prod. Res. Bd, Lond., 1954*, pp. 6–49, 8 pl., 1 fig., 2 graphs, 1955.

In the section of this report [cf. *R.A.M.*, 34, p. 562] dealing with mycology (pp. 25–31) it is stated that after four years under heavy medicinal paraffin oil 476 basidiomycete cultures out of 494 were still alive. Fungi which form acid and liquefy the medium do not preserve so well under oil. Good results with this technique were also obtained with cultures of ascomycetes and fungi imperfecti. The method would appear to serve the double purpose of protecting cultures from mites and retaining the vigour of fungi which deteriorate when frequently subcultured.

In a further study of the role of cellulose-destroying fungi in causing timber soft

rots [34, p. 561], nine microfungi, including *Chaetomium fumicola* and *Bispora pusilla*, were shown to cause soft rot under laboratory conditions. A close relationship exists between the amount of available nutrients (especially nitrogen and phosphate) and the rate of decay of beech sawdust caused by *C. globosum* [loc. cit.]; decomposition of beech wood blocks by this fungus was accelerated in soil to which a balanced fertilizer had been added.

Samples of wallboard prepared from the heartwood of East African pencil cedar (*Juniperus procera*) proved almost immune from fungal attack. An extract of mora saponin prepared from morabukea (*Mora gonggrijpii*) was strongly toxic to fungi.

The overgrowth of test pieces of mortar by *Merulius lacrymans* was prevented by the application of 0·8 per cent. sodium pentachlorphenate, 0·1 per cent. mercuric chloride, 2 per cent. phenyl mercuric dinaphthylmethanedisulphonate, 0·1 per cent. tri-ethyl tin hydroxide, some proprietary organic mercurials, and copper-8-quinolinolate. Sodium fluoride (4 per cent.), magnesium silicofluoride (10), and copper sulphate (10) were ineffective. Timber which had been thoroughly impregnated with sea-water was more resistant to [unspecified] dry rot fungi than that which had been merely surface-wetted, but was more hygroscopic.

It is concluded from temperature tests that for tropical hardwoods affected by stain due to *Diplodia* spp. it would be necessary to expose them to 65° C. for one hour to kill the fungus and prevent further attack during drying. *Diplodia* [*Botryodiplodia*] *theobromae* was able to advance nearly 1 cm. per day inside test sticks of ramin (*Gonystylus* spp.) at 22°. No evidence has been obtained that [unspecified] fungal growth was stimulated on woodwork treated with BHC, as had been reported.

The condition of beech logs left lying in grass under a hedge for up to 12 months was much better when they had been given a preliminary treatment with an antiseptic and the ends coated with bituminous paint than those not so treated.

Schulze (B.) & Gasda (G.). **Die Verdunstbarkeit von Holzschutzmitteln und ihre Prüfung.** [The vaporizing ability of timber preservatives and its evaluation.] —*Holzforschung*, 8, 2, pp. 49–53, 1 fig., 1 graph; 3, pp. 78–87, 11 graphs, 1954. [English summary.]

Studies on the rate of evaporation of timber preservatives, conducted with an apparatus specially devised by H. Wicht (*Wiss. Abh. dtsch. MatPrüfAnst.*, I. Folge, 5, pp. 38–39, 1940) are fully reported from the Laboratory for Timber Preservative Technology, Berlin. The method, involving accelerated evaporation in a wind tunnel, proved to be unsuitable for the assay of water-soluble (in contradistinction to oily) preservatives, and it was therefore supplemented by an accelerated biological test, using *Coniophora cerebella* [*C. puteana*], *Lenzites abietina*, and *Lentinus lepideus*, which requires an observation period of four months but is superior to the former method as a gauge of permanence of the protective.

Henriksson (S. T.). **Holztränkung nach der Wechseldruckmethode.** [Wood impregnation by the alternating pressure method.]—*Holz a. Roh- u. Werkst.*, 12, 6, pp. 233–241, 4 diags., 5 graphs, 1954.

A full explanation is given of the principles and practice of the alternating pressure method of timber preservation [*R.A.M.*, 34, p. 689]. It is based on the theory that the bordered pits in the wood vessels exert a kind of valvular action on the passage of the preservative during the impregnation process. The treatment involves the operation of a liquid pressure which must be alternately higher and lower than the prevailing atmospheric pressure in the wood. Experiments are described from the Boliden Mining Company, Skelleftehamn, Sweden, in the application of the new procedure to the impregnation of pine and spruce wood with water-soluble preservatives of the Boliden salt type.

Hicock (H. W.) & Olson (A. R.). **The toxicity to plants of wood preservatives and their solvents.**—*Circ. Conn. agric. Exp. Sta.* 189, 4 pp., 1954.

When tobacco plants were grown under shade tents with restricted air circulation in the presence of creosoted posts they were severely damaged. Injury was recurrent, indicating that appreciable quantities of creosote were volatilized from the posts even after several years. If, however, creosoting was restricted to the underground parts of the posts the plants were not damaged. Zinc meta-arsenite, Wolman salts, copper chromate, and zinc chloride caused no damage in similar tests.

Other tests were carried out to study damage which might be caused under greenhouse conditions by the use of pentachlorophenol or copper naphthenate, alone and together, with various commonly used solvents, including diacetone alcohol, mineral spirits, pine oil, kerosene, fuel oil, astral oil, and deodorized kerosene, which were also tested alone. The tests were of two kinds. In 'cage tests' the materials were placed in closed containers of approximate volume $\frac{1}{4}$ cu. ft. with potted tobacco plants 2 to 3 in. tall. Pentachlorophenol in crystal form caused severe injury to the tops of the plants. Copper naphthenate alone caused no damage. The solvents caused severe injury similar to that caused by pentachlorophenol. In 'flat tests' seed boxes were treated with pentachlorophenol or copper naphthenate dissolved in the various solvents, and also in Stoddard solvent, and given various times to dry out before planting. Damage was noted in every case, though in general the more volatile solvents dried out more quickly, leaving a smaller residuum which was slower in affecting the plants.

The authors concluded that copper naphthenate might with safety be used as a preservative for greenhouses and cold frames if a suitable solvent could be found. The solvents tested were not suitable.

Hicock (H. W.) & Olson (A. R.). **Preservation of woods by simple methods.**—*Bull. Conn. agric. Exp. Sta.* 581, 17 pp., 14 graphs, 1954.

This paper summarizes, with reference to the literature (20 titles), a number of ways in which posts and poles, with the sapwood intact, may be treated with preservatives by farmers and others having no access to commercially treated timber, and presents the results obtained in Connecticut over a number of years. The methods studied include the open tank method, using coal-tar creosote, cold soaking with oil-soluble pentachlorophenol, and several sap stream methods for treating green unpeeled posts and poles with zinc chloride.

The authors conclude that (1) none of the methods used afford penetration to the heartwood at the time of treatment; (2) poles and posts of non-durable woods should be given full-length treatments to obtain uniform protection; (3) impregnation methods are essential where the wood is to be in contact with soil; (4) the open tank method with creosote gives excellent results with pines and oaks, but with diffuse, porous woods such as maple, birch, and aspen [*Populus* spp.] it is not satisfactory owing to excessive absorption at the ends; (5) sap stream methods are useful for treating diffuse-porous and coniferous woods with zinc chloride [see next abstract].

Concentration is at first greatest at the intake end but it can be equalized by stacking the timber vertically with the intake end up. Records indicate that if any appropriate method is chosen a service life of at least 10 years can be expected.

Dunkelberg (G. H.). **The preservation of fence posts with water-soluble salts.**—*Bull. S.C. agric. Exp. Sta.* 409, 46 pp., 4 figs., 2 diags., 12 graphs, 1954.

This bulletin deals with investigations carried out at the South Carolina Agricultural Experiment Station of Clemson Agricultural College into the preservative treatment with zinc chloride and copper sulphate of various timbers used for fence

posts [cf. preceding abstract]. The suitability of some 30 varieties for treatment is tabulated, and the amount of absorption of the preservative and subsequent behaviour of posts of the various timbers is also tabulated and shown graphically.

Treatment of butts with zinc chloride (2 lb. to 1 gal. water) within two weeks of cutting is the most effective procedure. Bark need not be removed, and treated posts should stand butt end upwards for at least 60 days after treatment. Copper sulphate, which may be used similarly, is not satisfactory where metal wire or fasteners are used, owing to its corrosive effect. Six species of pine common to South Carolina are especially suitable, and treatment extends the average life of the posts to ten years and more as compared to less than two years for the untreated.

Moses (C. S.). **Condensation and decay prevention under basementless houses.**—*Rep. For. Prod. Lab., Madison*, 2010, 8+5 [unnumbered] pp., 1 diag., 3 graphs, 1954.

The writer points out that the growth of [unspecified] fungi causing decay of wood in houses without a basement is often due to condensation of water vapour from the soil below the house and may be prevented by covering this with suitable material such as asphalt roll roofing.

Fogl (E. R.). **The prevention of sap stain in Pinus spp.**—*Aust. Timb. J.*, 21, 6, pp. 477, 479, 554, 2 diags., 1955.

A preservative consisting of 4 lb. sodium pentachlorophenate and 12 lb. borax in 100 gals. water is reported to have been very effective in New Zealand [*R.A.M.*, 32, p. 52] in the control of sap stain [of unspecified origin], which is also prevalent in Australian plantation-grown softwoods. In some of the warmer north-coast areas of Australia it may be necessary slightly to increase the concentrations indicated. Brief descriptions are given of the construction and management of two types of tank, one for use in mills with a fairly large output and the other for small-scale undertakings.

Vukovits (G.). **Die Schwarzringfleckigkeit, eine Viruskrankheit der Kohlgewächse.** [Black ring spot, a virus disease of Brassicas.]—*Pflanzenarzt*, 9, 3, pp. 26–27, 2 figs., 1956.

Black ring spot virus disease of cabbage [cf. *R.A.M.*, 35, p. 338] was recorded in Vienna, Austria, in the summer of 1955 on white cabbage and cauliflower.

A brief description of the disease and its control is given.

MacFarlane (I.). **Variation in Plasmodiophora brassicae Woron.**—*Ann. appl. Biol.*, 43, 2, pp. 297–306. 1955.

After discussing evidence obtained by earlier workers indicating the existence of different races of *Plasmodiophora brassicae* [cf. *R.A.M.*, 21, p. 317; 31, p. 53, *et passim*], the author describes pot experiments, already briefly reported from Rothamsted Experimental Station [33, p. 587], in which three races of *P. brassicae* were distinguished by their different capacities to form clubs on different hosts. Race R was the stock culture, maintained on cabbage for some years [loc. cit.]; A was from swede (Agdell Field, Rothamsted) [loc. cit.]; and V was from Norway and resembled A but differed in its differential action on turnip and swede varieties.

On all crucifers tested the three races caused equal numbers of root-hair infections. *P. brassicae* is known to infect the root hairs of a number of non-crucifers, including some grasses, and it appears that there are two phases in the life-cycle of the fungus. The first can occur in many plants, infection of the surface cells of roots quickly producing thin-walled zoosporangia and zoospores. The second phase, more exacting in its requirements, is present only on crucifers, and then only on those specific to the particular race of *P. brassicae*.

Race R discriminated less between cabbage and radish than between cabbage and swede. Races A and V attacked cabbage and swede equally, but kale to a lesser degree, while Wilhelmsburger swede was more resistant than six weeks (SSW) turnip to race A and equally so with Wallace turnip, whereas it was much more susceptible than the latter to V and slightly more so than SSW. There appears to be no correlation between susceptibility to club root and taxonomic position within the Cruciferae. Susceptible and resistant varieties may be of the same species or occur throughout a number of species and genera.

The importance to agriculture of races of *P. brassicae* will depend on their distribution and prevalence. Cruciferous weeds need not necessarily serve as carriers for all races. Variation in *P. brassicae* has evidently been one of the chief causes of the failure of varieties developed for resistance to one race. The limitations of this breeding practice were shown by the complete susceptibility to race V of the Wilhelmsburger swede, bred for resistance in Denmark. Isolates of *P. brassicae* from as many sources as possible should be used in testing new varieties.

Hoffmann (G. M.). **Ein Beitrag zur Ätiologie des Rübenschorfes.** [A contribution to the etiology of Beet scab.]—*Phytopath. Z.*, **26**, 1, pp. 107–110, 2 figs., 1956.

Inoculation experiments with a spore suspension of *Streptomyces* [*Actinomyces*] *scabies* were performed on sugar and fodder beet seedlings growing in nutrient solutions at the Aschersleben branch of the German Biological Institute. The first symptoms of infection were already apparent after a fortnight in the form of a brown discoloration of the hypocotyl and main root, accompanied by the production of aerial mycelium. As with potato scab, shallow, knobby, and deep types [*R.A.M.*, 1, p. 183] were all recognized, occurring either singly or in combination. The disease thus induced is considered to be identical with the beet scab of Great Britain [29, p. 241] and the United States [32, p. 358] and probably distinct from the 'girth scab' reported from Germany [9, p. 152], the etiology of which remains obscure pending further investigations now in hand. It appears, however, to be favoured by damp, cold spring weather and by extensive soil incrustation, conditions which are adverse to the development of *A. scabies*.

Wenzl (H.). **Zur Frage der Saatgutübertragung der Vergilbungskrankheit der Beta-Rübe.** [On the question of seed transmission of the *Beta*-Beet yellows disease.]—*PflSchBer.*, **15**, 11–12, pp. 161–167, 1956. [English summary.]

A comparative experiment at the Federal Plant Protection Institute, Vienna, in which Rote Eckendorfer fodder beets were grown from (*a*) healthy seed and (*b*) seed from plants wholly infected by beet yellows virus [*R.A.M.*, 34, p. 13 *et passim*] yielded no evidence of disease transmission by seed.

Schuhmacher (G.). **Bekämpfung der Vergilbungskrankheit der Zuckerrübe im Rheinland. (Bericht über Versuchsanstellung und Bekämpfung 1952 und 1953.)** [Control of the yellows disease of Sugar Beet in Rhineland. (Report on the experimental procedure and control 1952 and 1953.]—*Höfchen-Briefe*, 7, pp. 157–204, 1954. [Abs. in *Z. PflKrankh.*, 63, 1, pp. 19–20, 1956.]

The first large-scale experiment for the control of beet yellows virus in western Germany [*R.A.M.*, 35, p. 256 and following abstracts] was undertaken in the Grevenbroich district of Rhineland in 1954, when the very satisfactory results of spraying with systox (400 ml. in 400 l. water per ha. for each application) under conditions exceptionally favourable to the virosis served as a basis for more extensive operations in the following year. These trials were carried out in the Bergheim and Cologne areas as well as Grevenbroich and covered over 42,000 ha. One treatment sufficed in view of the luxuriant development of the plants and the relatively slight infestation by aphids [? chiefly *Myzus persicae*]. On a rough computation the treatment resulted in an average yield increase of 9·8 per cent.

Koppelberg (B.) & Steudel (W.). **Die Auswirkungen des Systox-Einsatzes zur Bekämpfung der Vergilbungsschäden an Zuckerrüben im Rheinland 1954.** [The effects of the application of systox for the control of yellows damage on Sugar Beets in Rhineland 1954.]—*Zucker*, 9, 7, pp. 139–144, 2 maps, 1956.

This is a discussion and statistical analysis of the results of a co-operative spraying campaign with systox against beet yellows virus undertaken by five Rhenish sugar factories in 1954 [cf. preceding abstract]. The yields obtained from an area of 10,348 ha. were found to be uniformly higher in the treated than in the untreated fields, the increases rising from 6·97 doppelzentner [= 697 kg.] beets per ha. (2·04 per cent.) and 1·72 dz. sugar (3·4 per cent.) in the Kleve district at extreme north of the sprayed zone to a maximum of 47·7 (17·45) and 7·5 (20·6), respectively, in Krempen-Krefeld, followed by a gradual decline towards the south of the province (including Cologne, Düren, and Bonn). The beet and sugar yields in a southerly district were raised by 25·5 and 3·9 dz. per ha., respectively, by two aphicidal treatments as compared with 15·8 and 3, respectively, for one application.

Lüdecke (H.), Schlösser (L. A.), & Nitzsche (M.). **Über den Einfluß verschiedener Variante des Vergilbungsvirus auf Ertrag und Beschaffenheit der Zuckerrüben.** [On the influence of different variants of the yellows virus on the yield and composition of Sugar Beets.]—*Zucker*, 9, 8, pp. 169–180, 1 graph, 1956.

Although the results of experiments at the Institute for Sugar Beet Research, Göttingen, Germany, demonstrated differences in virulence among the several variants of the beet yellows virus isolated by Schlösser [*R.A.M.*, 32, p. 528], expressed in their effects on yield and chemical composition, no practical applications can be made of the knowledge thus acquired, since spontaneous field infections are almost invariably caused, not by individual variants, but by virus mixtures consisting of widely divergent types occurring in unknown proportions.

Ernould (L.). **Résultats obtenus dans la lutte contre la jaunisse de la Betterave en Belgique par traitements aux insecticides systémiques.** [Results obtained in the control of Beet yellows in Belgium by treatments with systemic insecticides.] —*Publ. Inst. belge Amélior. Better.*, 23, 3, pp. 147–223, 1955. [Flemish and English summaries.]

This is an important, fully tabulated survey of 18 field trials undertaken from 1950 to 1955 to determine the possibility of controlling beet yellows virus in Hesbaye, Hainault, and Flanders, Belgium [*R.A.M.*, 34, p. 694], by extermination of the aphid vectors, *Myzus persicae* and *Aphis fabae*, with pestox III, systox, metasystox, Bayer 4632, and Bayer 4633. Much of the information has already been presented, but the principal conclusions may be summarized.

Nearly all the aphids were killed by treatment with systox or one of the Bayer products at a dosage of 0·5 kg. per ha. and by metasystox at 1 kg. Two applications at fortnightly intervals reduced the number of reinfections in the field and mitigated the severity of the symptoms, but aphicidal treatment is considered to be generally profitable only in epiphytotic seasons, such as those of 1950 to 1952, though it may be justified during periods of lower incidence (1953 to 1955) in regions where moderate to heavy damage is habitually sustained (over 70 per cent. infection in mid-September). The systemic insecticides sometimes resulted in significant increases of yield, especially roots. Several non-systemic insecticides failed to raise production to a significant extent. To be economically worth while the treatments should produce a 7·5 per cent. increase in sugar content, which was secured by two applications of systox or metasystox. In districts where virulent outbreaks tend to occur (80 per cent. infection in mid-September), the first treat-

ment should be given when the number of *M. persicae* averages 0·5 per plant; elsewhere it may be delayed until there are one or two.

Webb (R. E.). **Cotyledonary inoculation, a method for screening Spinach for blight resistance.**—*Phytopathology*, 45, 11, p. 635, 1955.

The following method was used at the Plant Industry Station, Beltsville, Maryland, for testing the reactions of spinach seedlings to cucumber virus 1 [cucumber mosaic virus: *R.A.M.*, 32, p. 167]. Seeds of the resistant Virginia Savoy and susceptible Bloomsdale were sown in pots at 24° C. and the cotyledons of 30 plants of each variety inoculated as they approached full size with the virus maintained in stock cultures on *Nicotiana glutinosa*, the virus being applied with cheese cloth and carborundum dust. Another series of inoculations was performed as the first true leaves were attaining their maximum size. All the Bloomsdale plants in both groups contracted infection, but only two of the Virginia Savoys inoculated through the cotyledons and five through the true leaves. Tested by cotyledonary inoculation at 15° to 20°, 42 out of 45 Bloomsdale plants had developed the virosis by the end of 29 days, whereas all the 34 Virginia Savoys remained healthy.

Symptoms appeared on Bloomsdale plants inoculated through the cotyledons at the time of the appearance of the first true leaves, indicating that susceptible seedlings in a segregating population could be eliminated two to four weeks earlier by the former method than by the usual procedure.

Cotyledonary inoculations were performed on 249 plants of an F_2 segregating population from three parental combinations, which were subsequently held at 16° to 20° for 32 days. All the non-infected plants were reinoculated and later transplanted to 6-in. pots for observation. Eight additional plants developed blight symptoms. In similar tests on 149 F_2 progenies of seven parental combinations two of the apparently resistant plants contracted the disease on reinoculation.

At 16° to 20° infection of spinach plants with cucumber mosaic virus does not appear to modify seedling reaction to *Peronospora effusa* [29, p. 454]. The cotyledonary method may thus be used for the simultaneous testing of segregating populations for resistance to both virus and fungus.

Skotland (C. B.) & Hagedorn (D. J.). **Vector-feeding and plant-tissue relationships in the transmission of the Wisconsin Pea streak virus.**—*Phytopathology*, 45, 12, pp. 665–666, 1 fig., 1955.

Further observations on the feeding habits of the pea aphid *Macrosiphum pisi* [*Acyrthosiphon pisum*], an inefficient vector of Wisconsin pea streak virus [*R.A.M.*, 34, p. 338], demonstrated its preference for the phloem tissue, and next the parenchyma. Penetration was primarily intercellular, which appears to be less conducive to virus transmission than when intracellular, suggesting an explanation for the paucity of successful transfers by *A. pisum*.

Wade (G. C.). **Aphanomyces root rot of Peas—the effect of a potassium fertilizer on the severity of the disease in a potassium deficient soil.**—*J. Aust. Inst. agric. Sci.*, 21, 4, pp. 260–263, 1955.

In December, 1953, widespread damage to grey pea crops occurred in the Longford-Cressy district of Tasmania and some loss of blue peas was sustained in the Westbury area. The disease followed a period of heavy rain from 2nd to 6th November, and was most severe in flat, low-lying districts with badly drained soils of poor texture. In such situations plants over large areas became chlorotic and stunted, and the roots decayed and consistently bore numerous oospores of *Aphanomyces* sp. [*R.A.M.*, 15, p. 767]. Analyses of peas and soil from good and bad localities showed that all the unhealthy plants had a much lower potassium content than healthy ones.

In a greenhouse experiment air-dry soil from an infected area was placed in 30 canisters and brought to 50 per cent. of its moisture-holding capacity. Six canisters were autoclaved, and 12 were given potassium chloride at the equivalent of 4 cwt. per acre. Grey pea seeds were sown in each canister and the soil moisture maintained at 50 per cent. When the plants were 4 in. high, six canisters with added potassium, six without, and those autoclaved were brought to full moisture-holding capacity and kept at that level for one week, after which they were maintained at 50 per cent. The experiment lasted nine weeks.

After waterlogging, all the plants in the waterlogged series turned greyish and the leaflets rolled down. The plants in sterilized, waterlogged soil recovered, however, though the growth of those in the waterlogged, unsterilized without added potassium became chlorotic and greatly reduced. This latter series soon developed infection by *A.* sp. and 19 of 96 plants died. Growth in the waterlogged series with added potassium was much better, only one plant dying. In the non-waterlogged series attack by *A.* sp. was much more marked on the plants without added potassium than on those with it. The evidence suggests that the response to potassium was probably due more to nutrient than to osmotic effect.

Hubbeling (N.). **Physiologische specialisatie van Colletotrichum lindemuthianum en het kweken van resistente Bonenrassen.** [Physiologic specialization of *Colletotrichum lindemuthianum* and the breeding of resistant Bean varieties.]—Abs. in *Tijdschr. PlZiekt.*, 62, 1, pp. 23–24, 1956.

The author's studies on physiologic specialization in *Colletotrichum lindemuthianum* on bean [*Phaseolus vulgaris*] in Holland [*R.A.M.*, 34, p. 568; 35, p. 261] revealed a close agreement between Schreiber's group C [11, p. 618] and α of Roemer *et al.* [18, p. 196]. A fourth group was also differentiated which has been assigned to δ, although no comparative inoculation experiments have yet been performed with American material of the corresponding race [22, p. 50]. Resistance to race δ appears to be relatively infrequent, but it was encountered, e.g., in various 'plover' beans in combination with a similar reaction to α. Schreiber's Imuna proved to be susceptible to δ, though reasonably resistant in the field. On the other hand, the widely cultivated Stringless Double White is resistant to races β and γ, so there are encouraging prospects (already realized in the F_2) for the eventual development, by crossing these complementary varieties, of complete resistance in the field. The black-seeded, purple-shelled variety Cornell 49–242 appears to be resistant to both the American and Dutch physiologic races of *C. lindemuthianum*.

The segregation data obtained in these investigations point to a polymerous, dominant mode of inheritance of resistance.

Waitz (Loremaria), Gassner (G.), & Schwartz (W.). **Untersuchungen über die von Pseudomonas phaseolicola (Burkh.) hervorgerufene Fettfleckenkrankheit der Bohne. I. Methoden der Infektion von Versuchspflanzen.** [Studies on the grease spot disease of Bean caused by *Pseudomonas phaseolicola* (Burkh.). I. Methods of infection of test plants.]—*Zbl. Bakt.*, Abt. 2, 109, 5–8, pp. 140–156, 4 pl., 1956.

In this joint contribution from the Technical College, Brunswick, and the Institute for Microbiology, Mahlum über Derneburg, Germany, a method for the inoculation of bean [*Phaseolus vulgaris*] plants with *Pseudomonas* [*medicaginis* f.sp.] *phaseolicola* [cf. *R.A.M.*, 35, p. 262] by infiltration is fully described. The inoculum consisted of aqueous suspensions from cultures on 1·5 to 1·8 per cent. meat extract-peptone or carrot agar, in which seedlings 12 to 15 cm. in length were immersed under reduced pressure with the roots upwards until the intercellular system was practically permeated; at this stage the leaves appear dark green and watersoaked and the shoot axes glassy. Within two to five hours, at normal

pressure and according to the prevailing temperature, the plants regain their normal aspect, and after to one to three days 'grease spots' may be discerned.

The results obtained in tests on varietal reaction were in satisfactory agreement with those secured by Stapp's immersion procedure [15, p. 697], whereas injection of the primary leaves yielded conflicting data in certain cases. It is pointed out that the infection induced by infiltration and immersion involves primarily the intercellular spaces of the penenchyma, whereas injection operates predominantly in the conducting tissue. In the highly susceptible St. Andreas variety eight to ten bacterial cells sufficed to cause foliar mottling, while stunting followed the introduction of larger numbers.

Bremer (H.). **Die Mehlkrankheit der Zwiebeln (Sclerotium cepivorum Berk.). Ein Sammelbericht.** [The mealy disease of Onions (*Sclerotium cepivorum* Berk.). A collective report.]—*Z. PflKrankh.*, 63, 1, pp. 9–11, 1956.

White rot of onions caused by *Sclerotium cepivorum* was first reported from Germany by the author in 1934 [*R.A.M.*, 13, p. 614], since when no comprehensive account of the disease (which now appears to be resuming increased importance) has appeared in German. In this survey of 19 contributions to the literature essential information is presented on the geographical distribution, host range, life-history, mode of infection, temperature, moisture, and acidity relations, and control of the pathogen.

Thompson (R. C.). **Asparagus culture.**—*Fmrs' Bull. U.S. Dep. Agric.* 1646, 22 pp., 9 figs., 1954.

Diseases of asparagus are dealt with on pp. 20–22 of the new edition of this bulletin [cf. *R.A.M.*, 10, p. 288] in a section revised by S. P. Doolittle. In addition to rust, *Puccinia asparagi* [loc. cit.], the principal disease of the crop, reference is made to a wilt caused by a species of *Fusarium* in most producing areas of the United States, the affected shoots being stunted and sometimes brown on their surface. Soil where this disease has occurred should not be used again for asparagus.

Van Hoof (H. A.). **Vuur bij Andijvie.** ['Fire' in Endives.]—Abs. in *Tijdschr. PlZiekt.*, 62, 1, pp. 22–23, 1956.

'Fire' of endives, caused by *Marssonina panattoniana*, is severe in Holland only in cold, damp weather, whereas on lettuce [cf. *R.A.M.*, 35, p. 67] its incidence is practically constant all the year round. Spores are formed in profusion on endive agar. The author's isolate was pathogenic to its own host and chicory but not to daisy [*Bellis perennis*: loc. cit.]. In an experiment in which a field at the Phytopathological Institute, Wageningen, was inoculated with a spore suspension, maneb and captan reduced the percentage of infection from 100 to 20. Applied in good time, i.e., ten days after transplanting, maneb simultaneously controls *Alternaria* (?) *dauci* f.sp. *porri* [25, p. 581].

Marlatt (R. B.). **Brown stele of Lettuce.**—*Plant Dis. Reptr*, 39, 11, pp. 827–828, 1955. [Photo-offset.]

A head lettuce disease of unknown origin was observed for the first time in Arizona in 1952 in the Yuma Valley and again in 1953–5 in the Salt River Valley. The affected plants were slightly wilted and greyish-green in colour. During the cooler evenings the plants revived; the symptoms also disappeared in the cooler October weather. The root steles of severely diseased plants were reddish- or dark brown and hollow. In soil inoculation experiments none of the four bacteria isolated from diseased plants reproduced the symptoms. Root damage was much greater, with an average rating of 1·45 in the scale 0 (normal) to 3 (severely diseased), in field plots receiving 40 tons of manure per acre than in the untreated plots (0·525 and 0·503) or in those receiving 185 lb. calcium nitrate per acre (0·576).

Grogan (R. G.) & Schnathorst (W. C.). **Tobacco ring-spot virus—the cause of Lettuce calico.**—*Plant Dis. Reptr*, 39, 11, pp. 803–806, 1 fig., 1955. [Photo-ofiset.]

Greenhouse studies at the Department of Plant Pathology, University of California, Davis, on the physical properties, host range, and symptomatology of two strains of tobacco ring spot virus and one of the lettuce calico virus [*R.A.M.*, 33, p. 519] suggest that the latter is a distinct strain of the tobacco ring spot virus group. Both tobacco ring spot strains were able to protect tobacco against the lettuce virus, but the reverse could not be demonstrated.

Volcani (Zafrira). **An Onion and Tomato disease caused by a variety of Pseudomonas syringae.**—*Bull. Res. Coun. Israel*, 4, pp. 171–175, 5 figs., 1954.

A disease of onion leaves and tomato fruits, recorded for the first time in Israel in April, 1953, was caused by a variety of *Pseudomonas syringae* [*R.A.M.*, 32, p. 311]. The onion leaves showed water-soaked, transparent, soft spots, 10 to 20 mm. in diameter; the lesions on tomato fruits were small, brown, soft spots, very slightly sunken, 3 to 4 mm. wide. The organism was able to gain entry with or without wounding; attack occurred at temperatures of 12° to 14° C. and required a fairly high humidity. The optimum temperature for infection was 20° to 25°, and none occurred above 33°.

The bacterium produced typical black pit lesions on citrus fruits, induced soft rot of tomato and pepper fruits, and caused softening of potato and carrot slices in the presence of water, which distinguished it from a variety infecting avocado and lemon [loc. cit.]. Its pathogenicity to lemon also distinguished it from *P. syringae* var. *capsici* [21, p. 427]. With high humidity softening was induced by the organism in leaves of onion, tomato, pepper, potato, and bean.

Simons (J. N.). **The Pepper veinbanding mosaic virus in the Everglades area of South Florida.**—*Phytopathology*, 46, 1, pp. 53–57, 4 figs., 1956.

A virosis of California Wonder chilli (*Capsicum frutescens*), possibly identical with that described by E. L. Felix in 1946 (*Rep. Fla agric. Exp. Sta., 1945–6*, p. 191), was prevalent in the Everglades area of south Florida during the spring of 1954, causing losses of up to half the crop. The foliage showed marked veinbanding and was generally somewhat chlorotic. The fruits were roughened, with chlorotic spots or stripes, or both. Besides chilli, Rutgers and cherry tomato, Turkish tobacco, *Solanum elaeagnifolium*, *S. gracile* (which was also found naturally infected), and *Zinnia elegans* were susceptible in mechanical inoculation experiments, displaying definite symptoms of systemic infection, while *Portulaca oleracea* and eggplant appear to act as symptomless carriers. The virus was also transmitted by *Myzus persicae* and *Aphis gossypii*. Both the acquisition and inoculation threshold periods for *M. persicae* ranged from 0 to five seconds. Two-minute starvation periods after acquisition feeding caused a noticeable drop in infectivity, while an hour's fasting resulted in almost complete loss of virus.

The thermal inactivation point of the chilli veinbanding mosaic virus lay between 60° and 65° C.; its dilution end point was between 1 in 10,000 to 1 in 20,000; and longevity *in vitro* extended from 10 to 15 days. No close relationship with tobacco etch virus, the agent of a severe wilt of Tabasco chilli [*R.A.M.*, 33, p. 402], was indicated by immunological studies.

Verneau (R.). **Una alternariosi del Peperone.** [An alternariosis of Chilli.]—*Ric. fitop. Campan.*, 12, pp. 51–62, 4 figs., 1 graph, 1954. [English summary.]

A disease of pimiento [chilli] peppers, which usually becomes evident only during the operations preceding canning, frequently causes serious damage in Campania, Italy. The first sign is a translucent, oily, depressed lesion on the fruit surface, a

few mm. in diameter and generally one-third of the way from the stalk end, enlarging rapidly and turning bluish, particularly at the centre. The affected tissue subsequently becomes leathery and splits, revealing a dirty white mycelium which is soon covered by a velvety, olivaceous skin composed of a mass of conidia and conidiophores of *Alternaria tenuis* [*R.A.M.*, 34, p. 73]. Longitudinal sectioning of diseased fruits revealed a brownish tissue discoloration originating at the apex, and the seeds were also covered with mycelium and conidia which destroyed the seed teguments and attacked the embryo, thus preventing germination. Generally the fruits mummified but occasionally a bacterial soft rot developed. Usually only 5 to 6 per cent. of the fruits were affected soon after arrival at the canneries but later, just before processing, 25 to 30 per cent. had to be culled.

When about 400 fruits harvested 24 hours earlier were kept in the laboratory at temperatures varying from 10° to 30° [C.] for up to ten days the most damage occurred at the highest temperatures. In pathogenicity tests seven out of 25 chilli seedlings were infected and five out of 25 of tomato. Further experiments confirmed that infection occurred at the style and that the pathogen is normally present thereon, requiring favourable conditions of temperature and humidity to penetrate the fruits themselves.

For control the author suggests treatment of the seedlings with 1 per cent. Bordeaux mixture before the style has withered completely; this should be repeated whenever the weather is particularly wet. Delay in processing should be kept to a minimum and the storage temperature maintained at about 10°.

Storey (H. H.) & Ryland ([Mrs.] A. K.). **Transmission of Groundnut rosette virus.**—*Ann. appl. Biol.*, 43, 3, pp. 423–432, 1955.

In further studies on groundnut rosette in East Africa [*R.A.M.*, 32, p. 64; 34, p. 73] the virus was transmitted to groundnut plants (previously etiolated by being kept in darkness for 48 hours) by mechanical inoculation of the sap with added celite, but only a small proportion of the inoculations succeeded. A more satisfactory method was evolved using the vector *Aphis craccivora* and an adaptation of Posnette's half-seed method [26, p. 384].

Different races of *A. craccivora* appeared to vary in their inherent ability to transmit. Within transmitting races, all larval forms and alate and apterous adults might do so, but sometimes alatae and at other times apterae were significantly more efficient. Wingless forms moving over the soil surface may play a predominant part in secondary spread round an affected plant. The evidence obtained supported the view that infections by *A. craccivora* are individual and independent.

In serial infection tests, single aphids, tested for 24 hours on ten successive days without access to an outside source of virus, were able to produce infection on any day. A succession of one-hour tests on a single day gave similar results. In infected seed the virus rapidly became available to feeding aphids, non-infective aphids acquiring the virus by feeding on a seed during the third day after the first exposure of this seed to infective aphids.

Beattie (J. H.), Poos (F. W.), & Higgins (B. B.). **Growing Peanuts.**—*Fmrs' Bull. U.S. Dep. Agric.* 2063, 54 pp., 30 figs., 1 map, 1954.

Fungus diseases and physiological and deficiency disorders of groundnuts in the United States [see next abstract] are dealt with on pp. 25–33 of this bulletin. Seedling diseases are not generally serious, but there are several which may cause appreciable damage. Soil rot (*Rhizoctonia* [*Corticium*] *solani*) [*R.A.M.*, 31, p. 340] may attack plants up to six weeks old at the collar, and also later the whole plant in rainy weather. Southern blight (*Sclerotium rolfsii*) [33, p. 217] may cause considerable seedling loss and plant losses throughout the season. Bacterial wilt

(*Bacterium* [*Pseudomonas*] *solanacearum*) [32, p. 547] is seldom serious, and groundnut is resistant to the strain of the organism that attacks tobacco. Heat canker [33, p. 403] causes the greatest damage.

Spots on leaves, stems, and gynophores are caused by *Mycosphaerella arachidicola* and *M. berkeleyii* [17, p. 651; 33, p. 660, *et passim*]. Groundnuts should be alternated with maize or small grain crops where southern blight is troublesome.

In some varieties, especially those with large pods and seeds, the pods when lifted are discoloured and contain diseased seeds. This condition, known as black pod, is due to drought and deficiency of calcium, the latter being rectified by applying gypsum six to eight weeks after planting. Concealed damage [28, p. 381] may be countered by harvesting in cooler weather and by care in curing.

Higgins (B. B.). **Les maladies de l'Arachide aux États-Unis.** [The diseases of Groundnut in the United States.]—*Oléagineux*, 11, 4, pp. 213–220, 6 figs., 1956.

Notes are given on the symptoms, causes, and control of diseases of groundnuts in the United States [see preceding abstract], most of which have been noticed from time to time in this *Review*. Mention may be made of blight due to a *Botrytis*, probably *B. cinerea*, in cool wet periods at the northern limit of cultivation, Texas root rot (*Phymatotrichum omnivorum*) in the south-west, and black pod, due to calcium deficiency, which is common in Tennessee Red and Virginia types, but rare in Spanish lines. A bibliography of 33 titles is appended.

Kilpatrick (R. A.). **Longevity of Cercospora kikuchii on Soybean stems.**—*Phytopathology*, 46, 1, p. 58, 1956.

Soy-bean stems heavily infected with *Cercospora kikuchii* were collected from field plots at the Mississippi Agricultural Experiment Station [*R.A.M.*, 33, p. 525], Stoneville, in October, 1951, tied in a bundle, and hung outside the laboratory window. At six-monthly intervals portions were examined for sporulation of the fungus. Conidia were very abundant during the first 18 months, though generally decreasing at each successive examination. After 3½ years the pathogen could still be isolated.

Pierson (C. F.) & Walker (J. C.). **Relation of Cladosporium cucumerinum to susceptible and resistant Cucumber tissue.**—*Phytopathology*, 44, 8, pp. 459–465, 2 figs., 1954.

Most of this information on the development of *Cladosporium cucumerinum* in the susceptible National Pickling cucumber variety and the resistant Maine No. 2 at the Department of Plant Pathology, University of Wisconsin, has already been noticed [*R.A.M.*, 34, p. 76], but the following items may be mentioned. In the susceptible variety at 23° C. the intracellular habit of the hyphae in the stem was assumed slightly earlier than at 16°, and in both stem and leaf the extent of cell collapse and gum production was definitely less. At 27° penetration was not so frequent as at 23°, and the development of the pathogen in the leaf was usually checked after 96 hours by the collapse of the epidermal cells, sometimes accompanied by the breakdown and wall-thickening of the parenchyma cells. Stem lesion development ceased after 120 hours and there was no gummosis.

Ayers (T. T.) & Lambert (E. B.). **Controlling Mushroom diseases with chlorinated water.**—*Plant Dis. Reptr*, 39, 11, pp. 829–836, 3 figs., 1955. [Photo-offset.]

At the Horticultural Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, the use of chlorinated water (50 to 200, usually 100 p.p.m. of available chlorine) for wetting mushroom beds throughout the cropping season caused no yield reduction and effectively controlled bacterial blotch (*Pseudomonas tolaasi*) [*R.A.M.*, 30, p. 555], *Verticillium* sp. [loc. cit.], and

Mycogone perniciosa [30, p. 554] in trays inoculated with spore suspensions of the pathogens. It also prevented the development of an [unspecified] bacterial soft rot of the pinheads. Reports indicate that the practice does not affect the health of the consumer or grower. These results justify more extensive trials of chlorinated water in commercial mushroom houses. The solution should not be applied until the mushrooms begin to form. Soil sterilization and fumigation of empty houses are still essential. Zineb dusts for the control of *Verticillium* sp. and *M. perniciosa* may be omitted in the average house during the winter but should be applied as well as chlorinated water in damp caves and in houses in the late spring. [This paper also appears in *M.G.A. Bull., 1955,* 72, pp. 883–893, 3 figs., 1955.]

KUNDERT (J.). **Die Peronospora der Rebe und ihre Bekämpfung im Jahre 1955.** [The *Peronospora* of the Vine and its control in the year 1955.]—*Schweiz. Z. Obst- u. Weinb.*, 65, 5, pp. 103–109, 1 graph; 6, pp. 135–139, 1 fig., 1 graph, 1956.

Weather conditions in the Wädenswil district of Switzerland favoured the serious development of downy mildew (*Peronospora*) [*Plasmopara viticola*] in 1955, when the annual control experiments [cf. *R.A.M.*, 34, p. 830; 35, p. 269] were carried out in plots of the highly susceptible Riesling × Sylvaner on 101/14 and 1616 rootstocks, six fungicidal treatments being given between early June and the beginning of August. Total elimination of infection (100 per cent. efficiency) was secured by the use of captan at pre- and post-blossom concentrations of 0·15 and 0·3 per cent., respectively. Very satisfactory results were also given by combinations of captan and copper (0·4 and 0·4 per cent.), ziram and copper (0·3 and 0·5), and mesulfan Geigy (0·15 and 0·3), the efficacy of which was rated at 98·9, 98, and 93·3 per cent., respectively, and by a combined schedule of eight sprays, comprising three pre-blossom with cuprosan (0·4 to 0·7 per cent.), four post-blossom with Bordeaux mixture (1·6 to 2 per cent.) and one with 1·5 per cent. Bordeaux plus 0·15 per cent. ultraschwefel Geigy (93·3). Less effective were copper oxychloride-Bordeaux mixture (0·5 pre- and 1·5 per cent. post-blossom), copper oxychloride (0·5 and 0·75), and the same (0·3 and 0·3), with ratings of 90·1, 77, and 70·1 per cent., respectively.

The incidence of *Oidium* [*Uncinula necator*: 34, p. 275; 35, p. 275] on the vines treated with pure copper products, copper-containing organics, or pure organic preparations ranged from 0·4 to 1·4, 1·3 to 4·5, and 4·2 to 9·9 per cent., respectively.

Previous observations regarding the phytotoxicity of the various fungicides were confirmed, those containing copper being responsible for severe late-summer leaf scorch and sometimes punctures, accompanied in the case of the oxychlorides by bleaching, proceeding from the margins inwards, the latter being also a sequel to the combined ziram-copper treatment. Russeting of the grapes was another consequence of the use of pure or combined copper preparations, but this blemish also developed to a lesser extent on the untreated controls and is evidently attributable in part to rainy weather and for the rest to a varietal characteristic. As in 1954, the pure coppers had caused the most extensive defoliation by the end of October, when only 21 to 24 leaves per vine were left in these plots, compared with 40 and 41, respectively, for captan and mesulfan and 51 for zineb. The average yields of 100 vines treated with captan, zineb, and mesulfan were 173, 162, and 168 kg., respectively, compared with only 143 for the captan-copper combination, 132 for Bordeaux or copper oxychloride before and Bordeaux after the blossom, and 118 for copper oxychloride throughout the season.

EMILIANI (G.). **Quinta relazione su prove di lotta antiperonosporica con preparati cuprici ed organici.** [Fifth report on tests of downy mildew control with copper and organic preparations.]—*Boll. Staz. Pat. veg. Roma*, Ser. 3, 12 (*1954*), pp. 57–78, 1 graph, 1955.

In 1954 further spraying tests against vine downy mildew [*Plasmopara viticola*]

were carried out near Rome, in which nine materials were compared for fungicidal efficiency with 1 per cent. Bordeaux [cf. *R.A.M.*, 34, p. 342]. Eleven applications of each material were made, ten during the spring and summer, and one just before autumn. The disease was present during the spring and summer only.

The best results were given by tiezene (active principle, zineb), the protective ability of which was appraised (from the number of infected leaves in July) at a figure of 119, as against 100 for Bordeaux. The corresponding figures for the other materials were: manzate, 26·6; micronized Rumianca powder, 10; concentrated Caffaro powder, 9·5; orthocide (captan), 8·8; dithex ramato (zineb), 8; fuclasin ultra (ziram), 7·6; cuprosol, 4·9; and cuneese spray (aluminium sulphate and kaolin in equal parts), 2·4. Orthocide (captan) was insufficiently persistent in its action and its fungicidal effects could not, therefore, be accurately assessed. Percentage defoliation in October in the different treatments was as follows: orthocide, 100; manzate, 97·5; fuclasin ultra, 97·5; tiezene, 95; cuneese spray, 85; dithex ramato, 53; Caffaro powder, Rumianca, and cuprosol, each 30; and Bordeaux, 9·8, the effect of the last-named fungicide persisting much the longest.

Henner (J.). **Gefährliche Rotbrenner Spätinfektion und die Bekämpfung des Erregers im Jahre 1955.** [Dangerous late infection by rotbrenner and control of the pathogen in 1955.]—*Pflanzenarzt*, 9, 4, pp. 33–35, 1956.

The author compares various treatments in use in Austria against the rotbrenner disease of vine (*Pseudopeziza tracheiphila*) [cf. *R.A.M.*, 35, p. 272] and gives figures illustrating the results obtained in 1955 on the variety Silberweisse, which is particularly susceptible.

Bordeaux mixture (1·5 per cent.), dithane Z-78 (0·25), and copper with dithiocarbamate (0·25) all gave good control, though the May application of Bordeaux mixture caused scorching on all varieties. Copper oxide (0·75 and the same at 0·4) plus sulphur (0·5) were less effective. Orthocide 50 (0·25) gave insufficient protection.

It is pointed out that the danger of late infections at the end of August and the beginning of September is often overlooked by growers, who fail to give a late spray. In 1953 and 1954 heavy late attacks were noted on almost all untreated stocks.

Ciferri (R.). **Laciniatura primaverile e degenerazione infettiva della Vite.** [Spring laciniation and infectious degeneration of the Vine.]—*Atti Accad. Vite e Vino, Siena*, 4 (*1952*), [pp. 325–344, 1953. Received 1955.]

Observations and grafting experiments carried out at intervals in various parts of Italy since 1933 on the relation between leaf laciniation of vines and court-noué [*R.A.M.*, 32, p. 170 and next abstract] showed that transitory spring laciniation of European vines, observed only during cold weather [3, p. 503], always occurs on the same stocks [8, p. 13] and is transmissible by grafting to European vines. Laciniation persisting throughout the year (which does not differ substantially from the symptoms associated with 'persistant leaf curl') and not related, apparently, to cold, is transmissible by grafting from and to European vines, but not to vines affected by transitory laciniation. Transmissions from vines affected by either form of laciniation to the American vine Rupestris du Lot gave rise to the well-known symptoms of court-noué.

It is apparent, therefore, that transitory laciniation is due to an attenuated form of the virus causing permanent laciniation, and that both viruses can produce court-noué in susceptible American vines.

This result is at variance with the hypothesis that court-noué is caused by a virus accidentally introduced into Europe from America in vines brought over for their resistance to *Phylloxera*. On the contrary, court-noué would appear to be

endemic in European vines, and benign, at least when a very attenuated strain of the virus is responsible. The introduction into Europe of American vines, which had not been previously exposed to European viruses and were not resistant to them, occasioned a violent outbreak of court-noué on these. Court-noué in its European form has not been recorded on American vines in the United States [cf. 34, p. 343].

A comprehensive list of basic studies on the subject published between 1892 and 1952, inclusive, is appended.

Fogliani (G.). **Ricerche sperimentali sulla 'degenerazione infettiva' della Vite. Analisi dei sintomi da 'degenerazione' e da altre forme patologiche : descrizione, classificazione, e nomenclatura. Parte II.** [Experimental researches on 'infectious degeneration' of the Vine. Analysis of 'degeneration' symptoms and of other pathological manifestations: description, classification, and nomenclature. Part II.]—*Ann. Sper. agr.*, N.S., 9, 2, pp. 263–300, 20 figs., 1955. [English summary.]

In this further contribution [*R.A.M.*, 35, p. 271] the author lists with descriptive notes 55 further symptoms of abnormality observed by him on vines in Italy, 37 of which have been accepted by the Italian Sub-Commission of the International Office of Wine as of use in the diagnosis of court-noué [see preceding abstract]. In conclusion, the symptoms of court-noué are briefly recapitulated. A list of 17 references (Italian and French) is given.

Kunkel (L. O.). **Maintenance of yellows-type viruses in plant and insect reservoirs.** —The Dynamics of Virus and Rickettsial Infections, International Symposium, New York, pp. 150–163 [reprint repaged pp. 209–221], 1954.

In a study made at the Laboratories of the Rockefeller Institute for Medical Research into the efficiency of the leafhopper *Macrosteles fascifrons* as a vector of aster yellows virus [*R.A.M.*, 35, p. 2] four groups of the leaf hoppers were held on infected aster plants for two hours, one day, one week, and two weeks, respectively, and then allowed to feed individually on a different healthy aster or rye plant each succeeding day as long as the insects lived. The numbers transmitting in the four groups, respectively, were six out of 50, 47 out of 72, 42 out of 50, and 53 out of 56. Although most if not all individuals are susceptible to infection by the virus, some are apparently much more so than others. Many individuals remain infective to the end of their lives, and although proof is lacking that all do so, there is no evidence to the contrary. The insects allowed long infective feeding periods transmitted the virus to slightly higher percentages of plants than those given short ones. This leafhopper is apparently an efficient vector and an extremely good reservoir of the virus.

Bawden (F. C.) & Harrison (B. D.). **Studies on the multiplication of a Tobacco necrosis virus in inoculated leaves of French-Bean plants.**—*J. gen. Microbiol.*, 13, 3, pp. 494–508, 3 graphs, 1955.

At Rothamsted Experimental Station leaves of Prince French bean plants (*Phaseolus vulgaris*) treated with ribonuclease or floated in water during the first hour following inoculation with the Rothamsted tobacco necrosis virus [*R.A.M.*, 35, p. 150] sustained less infection than untreated leaves. After two hours at 25° [C.] the virus was less readily inactivated by ultraviolet light than before, suggesting that the infected cells then contained more of the substances that absorb radiation of 2537 Å. After four hours the inactivation curve deviated from the course of a first-order reaction, while after six hours some lesions were formed, suggesting that newly-formed virus had spread from initially infected cells to deeper tissues where it was protected from irradiation. The virus spread from the initially infected cells

in an average of 12·5 hours at 16°. Newly-formed virus was not detectable in extracts of inoculated leaves until after it had spread from the epidermis to the deeper tissues, about 20 hours after inoculation.

Van der Want (J. P. H.). **Transmission of Tobacco-rattle virus by means of Dodder.**—*Plant Dis. Reptr*, 39, 7, pp. 553–554, 2 figs., 1955. [Photo-offset.]

At the Rockefeller Institute for Medical Research, New York, potato stem-mottle virus was transmitted from diseased to healthy aster by *Cuscuta campestris* but not by *C. subinclusa* [*R.A.M.*, 34, p. 679].

Silberschmidt (K.). **Asclepias curassavica, a natural host of Cucumber-mosaic virus in Brazil.**—*Plant Dis. Reptr*, 39, 7, pp. 555–557, 3 figs., 1955. [Photo-offset.]

Asclepias curassavica near São Paulo, Brazil, was found to be affected by cucumber mosaic virus, the symptoms (curled leaves with chlorotic bands or annular chlorotic spots) resembling those previously described on *A. syriaca* [*R.A.M.*, 5, p. 142]. In inoculation tests at the Biological Institute with several strains of the virus infection was reproduced in seedlings of *A. curassavica* only with the strain originally derived from the same host.

Crick (F. H. C.) & Watson (J. D.). **Structure of small viruses.**—*Nature, Lond.*, 177, 4506, pp. 473–475, 1956.

The purpose of this article from the Cavendish Laboratory, Cambridge, is to explain, by means of the simple hypothesis that a small virus contains identical sub-units packed together in a regular manner, why almost all small viruses are either rods or spheres. Assuming that the basic structural requirement for a small virus is the provision of a rather large shell of protein to protect the ribonucleic acid within, it is easier for the virus in a living cell to control the production of a large number of identical small protein molecules for this purpose rather than a few very large ones. These small molecules then aggregate in a regular manner around the ribonucleic acid but in a limited number of ways, if they are to use the same packing arrangement repeatedly. Hence small viruses are either rods or spheres. The number of sub-units in a rod-shaped virus, such as tobacco mosaic, is probably unrestricted, but for spherical viruses, such as turnip yellow mosaic and [tomato] bushy stunt [see next abstract], the number will probably be a multiple of 12. Every small virus will contain symmetry elements and in favourable cases these can be discovered experimentally. This hypothesis, in the form presented herein or a simple variant of it, is likely to apply to all small viruses of fixed size and shape.

Caspar (D. L. D.). **Structure of bushy stunt virus.**—*Nature, Lond.*, 177, 4506, pp. 475–476, 2 diags., 1956.

The X-ray evidence from studies at the Cavendish Laboratory, Cambridge, showed that [tomato] bushy stunt virus possesses sub-units [see preceding abstract], the number certainly being a multiple of 12 and probably a multiple of 60. The chemical data suggest that the actual number may be as high as 300.

Knight (C. A.). **Are Cucumber viruses 3 and 4 strains of Tobacco mosaic virus? A review of the problem.**—*Virology*, 1, 3, pp. 261–267, 1955.

The writer considers the suggestion that on general characteristics and physical-chemical properties cucumber viruses 3 and 4 [cucumber green-mottle mosaic virus and a strain of it, respectively: *R.A.M.*, 14, p. 554] are distantly related strains of tobacco mosaic virus, using these examples to discuss in general the criteria of virus strain relationships. He concludes that although the two cucumber

viruses resemble tobacco mosaic in some general chemical and physical properties, in size and shape of particles, method of transmission, ability to interfere with its reproduction, and a degree of positive serological crossing, yet they are not, in fact, strains of this virus. They differ from it in host range, they contain a different ribonucleic acid, and have a different peptide structure, and they have no sulphur-containing amino-acid.

ROLAND (G.). **Nieuwe opzoekingen over de virusziekten van enkele planten.** [New researches on the virus diseases of some plants.]—Reprinted from *Verh. vlaam. Akad. Wet.*, **16**, 48, 84 pp., 15 figs., 1954. [Received 1956.]

The following are some of the main conclusions of this important, fully tabulated study on plant viruses conducted at the Phytopathological Station, Gembloux, Belgium. Potato varieties differ markedly in their reaction to inoculation with potato virus Y by *Myzus persicae* [*R.A.M.*, 29, p. 177], Ackersegen and Mittelfrühe, for instance, being very susceptible, while Voran and Bintje are much more resistant. Transmission to the latter variety was more readily effected in a cool (10° to 17° C.) than in a warm greenhouse (17° to 22°). Plants of the Craigs Defiance and Eigenheimer varieties were reasonably good virus sources, while Ackersegen gave very poor results. It appears from the results of serological tests [25, p. 250] that infected plants of Craigs Defiance are actually richer in virus than those of Ackersegen. Tobacco and tomato are better virus sources than petunia, and the first-named should be used if possible both for this purpose and as a test plant.

In tests on young tomato plants with potato virus Y, movement away from the inoculated leaf did not generally take place until after the tenth day. Thenceforth the virus spread rapidly both upwards and downwards in the stem and into the youngest leaves; invasion of the oldest ones took place very slowly or not at all, the first and second still being virus-free after 15 days. The results of other tests showed that the secondary stems of a given plant may be used for repeated inoculations about three weeks after removal of the tops.

The results of two experiments involving the exposure of 19 potato varieties to natural infection by the Zeeuwse Blaue strain of potato virus Y [33, p. 171] revealed a very low degree of susceptibility; Flämingskost, Present, and Thijn 3635 remained healthy throughout. Thus, the severe necroses resulting from inoculation of the same varieties with the Z.B. strain are not a sign of hypersensitivity connoting field immunity.

The strain of potato virus Y carried by the Zeeuwse Blaue and Zeeuwse Bonte varieties sometimes comprises at least two variants, viz., C and Y, the former non-transmissible and the latter transmissible by *M. persicae*. In inoculation experiments with 13 strains of the virus (including variant C) on Samsun tobacco, *Nicotiana glutinosa*, *Physalis floridana*, and the Ackersegen and Bintje potato varieties, not only did the individual strains differ in virulence but their pathogenicity to the same host was not uniformly constant, indicating the existence of more than one variant in their composition. On account of these discrepancies different strains should be used in studies of varietal reaction in potato.

The influence of seasonal factors on the reaction of tobacco varieties to potato virus Y was clearly demonstrated by inoculation experiments performed on 18th July and 27th December, 1953. In the former only five out of 20 plants of four supposedly resistant varieties contracted infection in a masked form, whereas in the latter all did so and developed veinbanding, one severely. It is evident, therefore, that the interpretation of the results of varietal reaction tests requires great care, since the responses vary so much according to the season.

Eight isolates of potato virus X from different potato varieties induced very similar reactions in Samsun tobacco, but their effects on *Datura stramonium* were quite divergent, including the development of large, yellowish spots between the

veins and of dark green bands along them, generalized pallor of the leaves with or without a few small, green areas, and green interveinal spots, swellings, and isolated reddish, necrotic dots on the leaves. On this basis the symptoms caused by the isolates from Arran Crest, Immune Ashleaf (Juli), and Arran Victory would agree more or less with Salaman's X^D, those from Katahdin and British Queen with X^G, and the international Kidney and Eersteling [Duke of York] strains with X^L, while the Bintje isolate resembles a weak X^S [18, p. 130].

The red- and the white-flowering varieties of *Gomphrena globosa* proved equally useful in further identification studies on potato virus X [35, p. 37], the leaves of both responding to inoculation with all eight isolates by the development of small, red spots with a greyish or brownish centre (abs. in *Phytopathology*, 38, p. 28, 1948).

All the isolates withstood 10 minutes' exposure to a temperature of 70°, while the British Queen strain was still active at the exceptionally high one of 80°. The virus was inactivated at pH 1·5, 2, 3, and 12 [*R.A.M.*, 18, p. 269].

The results of a study on the reactions of 16 potato varieties to the virus X isolates from Arran Victory, British Queen, Katahdin, Bintje, and Arran Crest indicated that resistance is controlled by more than two factors [cf. 23, p. 144; 32, p. 144].

The immunity from potato virus X of the American hybrid 41956, already demonstrated by other workers [22, p. 76; 35, p. 119], was corroborated.

The identification of potato virus A [33, p. 171] presents great difficulties but was accomplished by grafting on the 'S' variety of *Solanum demissum* [32, p. 273; 35, p. 119] or on Great Scot, while sap inoculation on detached leaves of *S. demissum* was also successful in the absence of potato viruses X and F [24, p. 244]. In experiments on the transmission of virus A by *M. persicae* [29, p. 636], the best results on *S. demissum* were secured with feeding times ranging from two minutes to one day on the diseased potato sources and three days on the test plants, the corresponding periods required on Samsun tobacco being 10 to 40 seconds and one day, respectively. The problem of field immunity from potato virus A [33, pp. 171, 497] is also very complex. It would appear from further experiments that the necrotic (hypersensitive) reaction to inoculation does not necessarily connote freedom from infection in the field, since Ackersegen, Bintje, Gineke, Katahdin, and Primula, for instance, which are susceptible to natural infection, developed necrotic symptoms in inoculation tests.

Potato virus F is identifiable by sap inoculation on detached leaves of *S. demissum*. Transmission by means of *M. persicae* proved very difficult [16, p. 117]; the inoculated plants showed no symptoms but the presence of the virus in two out of ten 'light' Industrie potato plants was verified by sap inoculations on chilli.

A method for the serological investigation of potato virus S [35, p. 536] is fully described. Sap transmission is readily effected, especially to the Bintje and Eigenheimer varieties. Of 37 Solanaceae tested for reaction to virus S, 26 were susceptible, namely, *Datura metel*, tomato, *Nicotiana rustica*, *S. acaule*, *S. andigenum*, *S. chacoense*, *S. caldasii*, *S. commersonii*, the 'S' variety of *S. demissum*, *S. goniocalyx*, *S. longipedicellatum*, *S. polyadenium*, *S. pseudo-capsicum*, *S. subandigenum*, and 12 other *S.* spp. The virus was present in all the 40 commercial potato varieties examined serologically in 1953, and it is considered unlikely that any are immune.

A strawberry virus closely resembling Prentice's No. 1 [strawberry mottle virus: 32, p. 573] appears to be widespread in Belgium.

To the list of hosts of turnip mosaic virus already published [32, p. 294] may be added *D. metel* and *N. rustica*.

Noordam's strain *Chrysanthemum* (st. Chr.) of cucumber mosaic virus [32, p. 559] was isolated from a chrysanthemum plant of the Toi et Moi variety. The most remarkable feature of the variant is its inability to infect cucumber.

Beal (J. M.), Preston (W. H.), & Mitchell (J. W.). **Use of 2,3,5-triphenyl tetrazolium chloride to detect the presence of viruses in plants.**—*Plant Dis. Reptr*, 39, 7, pp. 558–560, 1955. [Photo-offset.]

A colour test for detecting viruses in plants is described from Beltsville, Maryland. Infected and virus-free stem sections, at least 1 mm. thick, placed in 0·5 to 1 per cent. aqueous 2,3,5-triphenyl tetrazolium chloride, change from green to rust, then amber, and finally blood red. The change is much more rapid in infected tissue, with a maximum difference at 35° C. within 15 to 30 minutes of immersion. The different colour stages are assigned the numbers 0, 1, 2, and 3, respectively, and by multiplying the number of sections of a specific colour by the corresponding colour number a colour index is obtained.

Limasset (P.). **Sur les principes d'une classification naturelle restreinte des virus des plantes et l'importance relative du critérium morphologique.** [On the principles of a natural restricted classification for plant viruses and the relative importance of the criterion of morphology.] *Ann. Éc. Agric. Montpellier*, 29, 3–4 (numéro spécial dédié au Professeur G. Kuhnholtz-Lordat), pp. 89–94, 1954.

The author discusses current trends in virus classification [*R.A.M.*, 35, p. 78] and recommends the grouping into families of the few viruses that are classifiable at present by their morphological characters. In this way the genera *Baculus* (including tobacco mosaic virus), *Capillus* (with potato virus X), and *Fustis* (with potato virus Y) would be combined in the family Baculaceae, and the nomenclature would be seriously affected only if the genera themselves were subsequently split up. It is considered advisable at the outset to erect well-defined genera that include viruses of which a wide range of properties is known in addition to their morphology.

Bawden (F. C.). **Plant pathology department.**—*Rep. Rothamst. exp. Sta., 1954*, pp. 80–95, 1955.

In the section of this report [cf. *R.A.M.*, 35, p. 149] dealing with virus diseases further studies on tobacco mosaic virus are described. The proportion of short particles is now much smaller than formerly, suggesting that the stock culture may have altered. An American and an Indian strain, though serologically related to the Rothamsted stock culture, appeared to share no antigens with cucumber viruses 3 or 4 [cucumber green mottle mosaic and a strain or suspected strain of it: see above, p. 580], which are also serologically related to the stock culture. Confirmation of this would show a new type of virus relationship, two viruses having antigens in common with a third, but not with each other.

F. C. Bawden and A. Kleczkowski state that preparations of all four strains of tobacco mosaic virus studied, when partially inactivated by exposure to ultra-violet radiation, had the same infectivity, relative to non-irradiated preparations, whether the plants were kept in the light or the dark after inoculation. With six other viruses, however, irradiated preparations produced more lesions when the inoculated plants were placed in the light than in the dark. The quantitative response was greatest with potato virus X, irradiated preparations of which gave 20 or more times as many lesions on plants in the light as in the dark, the time needed in light depending on the interval between inoculation and exposure. If the plants were placed in the dark for the first hour after inoculation (30 minutes or less has little effect), 15 and 30 minutes' exposure to light greatly increased the number of lesions. After two to three hours in darkness, light has little effect. It seems that during the first hour or so after inoculation the virus particles change, the ability of those damaged by ultra-violet light to multiply being affected by

visible light. This sensitivity persists for about one hour, during which if the particles do not start to multiply they are apparently destroyed.

F. C. Bawden and B. D. Harrison also found that a change in the condition of Rothamsted tobacco necrosis virus during the first hour or two in inoculated leaves of French beans [*Phaseolus vulgaris*] was suggested by experiments in which such inoculated leaves were irradiated with ultra-violet light. At times up to one hour after inoculation a constant amount of irradiation gave a constant decrease in the numbers of lesions produced by a given inoculum, after that it gave less. At 25° C. the results were compatible with the hypothesis that substances that absorb ultra-violet start to be synthesized about one hour after the cells have become infected, new virus particles begin to appear two to four hours after, and some of these move from the epidermis to the palisade cells within six hours of infection. Experiments with inhibitors of infection also suggested that changes occur in infected cells after about one hour, but it may be that temporary injury to cells at inoculation prevents the entry of inhibitors with large particles for an hour or so. Inhibitors with small particles, e.g. trichothecin with French bean and thiouracil with tobacco, produce effects if applied many hours after the inoculation, but these can penetrate deeply into uninjured leaves and may act by preventing the spread of virus from cell to cell, rather than by influencing multiplication in cells where it has already started.

B. D. Harrison showed that three days after inoculation the amount of Rothamsted tobacco necrosis virus in French bean leaves kept at 22° C. was 4,000 times greater than in leaves at 10°, and 1,000 times greater than at 30°. When leaves kept at 22° for two days after inoculation were placed at 30° for one day, their virus content fell to one-fifth, increasing again when they were returned to 22°. It is thought that the virus is simultaneously synthesized and broken down at all these temperatures, but that the ratio of breakdown to synthesis increases as the temperature rises. The period after inoculation during which irradiation of leaves with ultra-violet decreased the number of lesions produced by this strain of tobacco necrosis virus was curtailed by increasing the temperature to 22°, but not between 22° and 31°. This period is thought to be that necessary for virus to multiply in the epidermal cells and move to deeper tissues.

In studies by B. Kassanis on the variation of virus concentration through plants tomato roots infected with tobacco mosaic virus were grown in culture, and cut pieces tested for virus content. All parts contained virus, but the older much more than the younger. Similarly the enclosed buds of systemically infected tobacco plants contained much less virus than the young leaves, which in turn contained less than those older.

The carnation latent virus, though serologically related to one that occurs in apparently healthy potato plants [33, p. 483], is not antigenically identical with it. The two are also transmitted differently and infect different plants. The potato strains are apparently the same as potato virus S [35, p. 480 and above, p. 582].

H. L. Nixon and H. L. Fisher, studying with the electron microscope the changes in tobacco leaf cells induced by tobacco mosaic virus, found the most suitable material to be the youngest leaves as they become invaded by virus from older, inoculated leaves. No morphological changes were detected in the early stages of infection. At about the time inclusion bodies begin to form, some of the chloroplasts change in appearance, and the usual layer structure of the grana becomes replaced by granular vacuolate material. The thinnest sections showed that the granules have a similar cross-section to that of tobacco mosaic virus particles; the cut surfaces of such chloroplasts resemble those of virus particles in the inclusion bodies. The spray-drop technique of Backus and Williams [31, p. 212] was modified to form the basis of a routine method developed for counting virus particles, but many technical difficulties were encountered.

The results of field experiments on potato virus diseases [35, p. 117] and studies on the transmission of cauliflower mosaic virus by aphids have already been noticed [34, p. 762].

L. Broadbent and G. D. Heathcote found that the incidence of cauliflower mosaic virus [35, p. 147] and tip-burn (scorch) in St. George and Early Extra Roscoff cauliflowers increased with more nitrogen, but tip-burn was not caused by the virus. The mortality of St. George during winter was unaffected by the presence of the virus, which did, however, decrease curd size and increase the number of 'bracty' and loose curds. At Luddington [Lincs.] an early-sown barrier of a single row of barley round each cauliflower seed-bed reduced the incidence of cauliflower mosaic virus to one-quarter of that in the controls in four-row seed-beds and to one-half in 22-row seed-beds.

A strain of turnip yellow mosaic virus found near Newcastle was ascertained by L. Broadbent and J. W. Blencowe to differ from that prevalent near Edinburgh in severely affecting cabbage, cauliflower, and kale. Another virus affecting turnips was found at Edgell (Scotland) and provisionally named turnip crinkle virus. It infects cabbage and cauliflower, but not severely, and is transmitted by flea beetles [*Phyllotreta* spp.].

Marion Watson and G. E. Russell report that of a number of varieties of wild and cultivated beet tested, all proved equally easy to infect with beet yellows virus by means of aphids, but developed symptoms differing in severity. *Beta maritima* varieties were more tolerant than crosses between *B. maritima* and *B. vulgaris* and these more than *B. vulgaris*. The seedlings of a given variety often developed more severe symptoms when colonized by several infective aphids than when single aphids were used.

R. Hull and Marion Watson state that the relationship of yellow net virus [33, p. 460] to beet yellows virus remains obscure, but the multiplication of the former is reduced by the presence of yellows strains, particularly by virulent ones. By itself, yellow net cripples beet plants and yellows them almost completely; plants already infected are not, however, protected against virulent yellows virus, which seems to multiply normally and produces its typical symptoms on young leaves.

R. Hull and D. H. Firth inoculated uniform crops of three commercial beet varieties with a strain of yellows virus causing etch symptoms, one causing chlorosis, and also a mixture of the two. The varieties became equally infected, and the three treatments gave yields of 10·85, 9·08, and 8·8 tons per acre, respectively, as against 19·02 for the healthy plots. There was less difference in the appearance of plants in the field than was expected from the behaviour of the strains under glass.

J. W. Blencowe, L. F. Gates, R. Hull, and D. H. Firth found that the proportion of plants affected by yellows virus in six root crops in Lincolnshire and Norfolk sprayed once (in mid-June or early July) with systox at 400 gm. per acre was reduced to less than one-half that in the unsprayed. Spraying on both dates had little additional effect, but a third spray, at the end of July, reduced the proportion of affected plants by a further one-third. Spraying increased the yield from 1·75 to 3·5 cwt. per acre. At Dunholme [Lincs.], the incidence of yellows was not affected by different amounts of fertilizer or by width of spacing, but early sowing increased it, and spraying reduced it to one-fifth.

L. F. Gates reports that seed crops planted with unsprayed stecklings had 73 per cent. yellows, while the percentage in crops from stecklings sprayed three times in autumn was: systox, 30; hanane, 28; schradan, 34; and NC 7, 22.

An examination by R. Hull of 200 plants of 13 weed species suitably sited to contract beet yellows virus showed six to contain viruses transmissible by *Myzus persicae* to sugar beet. Two plants of *Senecio vulgaris* and one of *Capsella bursa-*

pastoris contained beet yellows virus, and one of *Rumex crispus* an unidentified virus that stunted, mottled, and yellowed sugar beet.

In the mycological section of this report J. M. Hirst and O. J. Stedman state that though potato blight (*Phytophthora infestans*) [35, p. 319] became general in 1954 at about the same time as in 1953, and developed at the same rate, in the former year two applications of a copper spray increased the yield by 2·4 tons per acre, as against 0·5 tons in 1953. The difference is attributable to the cooler summer of 1954, which caused the crop to mature later and be more affected by blight. Spore traps [33, p. 615] operated in potato fields caught 14,700 sporangia of *P. infestans* per cu. m. air on 21st August.

J. M. Hirst and G. A. Salt frequently found a fungus indistinguishable from *Oospora pustulans* [34, p. 812] in brown lesions on potato roots, stolons, and stems below ground. Addition of this fungus to the soil at planting increased the number and size of subsequent lesions.

Spore-trapping experiments in a wind tunnel by J. M. Hirst and O. J. Stedman showed that ascospores of *Venturia inaequalis*, released after wetting dead scabby apple leaves, reached a peak between 1½ to 3 hours later, those of *Ophiobolus graminis* from wheat in less than an hour. Few *V. inaequalis* spores were released after atomizing water equivalent to 0·2 mm. of rain over scabby leaves, suggesting that dew does not normally release many.

Mary D. Glynne, G. A. Salt, and D. B. Slope secured further evidence that the optimum seed rate for wheat depends on whether or not the land is infested with eyespot (*Cercosporella herpotrichoides*) and take-all [*Ophiobolus graminis*]. If it is, a rate of 1½ bush. of Squarehead's Master yields a better crop than 3 bush., but on clean land the higher rate gives an equal or better yield. Disease surveys of the wheat experiments at Rothamsted revealed an exceptionally high incidence of eyespot.

Investigation of pea diseases by E. W. Buxton has been noticed from another source [35, p. 411]. Several cultures of *F. oxysporum* from the roots of diseased Sitka [spruce] seedlings in forest nurseries were pathogenic when inoculated to Sitka seedlings under glass.

In further studies on club root of crucifers (*Plasmodiophora brassicae*) [35, pp. 255, 568] I. Macfarlane found that when [unspecified] young seedlings were grown singly in tubes containing spores of the fungus suspended in Hoagland's solution and incubated at 25° C. in the dark, the number of infections obtained depended on the interaction of the numbers of spores present, the concentration of the culture solution, and its pH. At high spore concentrations changes in pH or in spore concentration had less effect than at low ones; at certain spore concentrations, diluting the solution reduced the influence of pH.

Continued tests by L. F. Gates to control seedling diseases of sugar beet [cf. 34, p. 692] gave further evidence of the benefits derived from soaking seed for 20 minutes in 0·004 per cent. solution of ethyl mercury phosphate; in 13 of 14 plantings this treatment gave an average of 25 per cent. more seedlings than dressing the seed with agrosan. In soil artificially contaminated with *Pythium debaryanum* and *Rhizoctonia* [*Corticium*] *solani* the application of various fungicides to the drills immediately before sowing increased the stand of seedlings, in the case of formalin by more than 50 per cent.

C. E. Cornford found that *Botrytis cinerea* does not attack stored beets [cf. 35, p. 143] cut during summer, but those cut after November become susceptible, bruised tissue giving more ready entry than cuts. When untopped roots were cut lengthways and the cut tissue inoculated the lower parts became infected, but not the upper early in the storage period. With increasing age more of the root becomes susceptible, and by February only a small band of tissue immediately below the crown remains resistant. The resistant tissues were ascertained by spore-germina-

tion tests to contain a fungistatic substance not present in detectable amounts in the susceptible tissues. *B. cinerea* was found to be the most important fungus causing rots of clamped mangolds and fodder beet.

Jahresberichte der Pflanzenschutzämter 1953. [Annual reports of the Plant Protection Bureaux 1953.]—144 pp., Biologische Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, 1955.

This publication [cf. *R.A.M.*, 35, p. 416] contains reports from the plant protection bureaux of the West German 'Länder', noting the incidence of disease and outlining the activities of the services. Much of the information has been noticed in this *Review* from other sources.

Neveling (C. H.). **Report of the Secretary for Agriculture for the year ended 31st August, 1955.**—*Fmg in S. Afr.*, 31, 359, 176 pp., 1956.

In the Plant Pathology section of this report from South Africa [cf. *R.A.M.*, 35, p. 162] J. E. Van Der Plank states (pp. 94–95) that *Helminthosporium* leaf blight of maize (*H. turcicum*) [34, p. 324] was particularly destructive. Gladioli near Krugersdorp were nearly all severely affected by *Botrytis cinerea* [cf. 34, p. 38]. Cabbage black rot (*Xanthomonas campestris*) appears to be on the wane and rice blast (*Piricularia oryzae*) [34, p. 436] was less severe because less of the highly susceptible variety DS 1 was grown.

The results of transmissions from orchard citrus trees to indicator seedlings showed clearly that qualitative differences exist in the virus content of different orchard trees, particularly in trees of different species. One unexpected result was the discovery of the loss of the seedling yellows-virus component from young grapefruit trees, which had been inoculated in the greenhouse and were systemically infected when planted out, indicating that this host is able to free itself from the component by some mechanism that may be linked with localization of the virus. While grapefruit trees can be regarded as field-immune from seedling yellows a variable percentage of young seedlings in the greenhouse developed systemic infection after aphid inoculation, demonstrating the caution necessary in interpreting the results of such experiments.

Samples of kaffircorn [*Sorghum caffrorum*] seriously affected by *Ramulispora sorghi*, previously unrecorded from South Africa, were received from Bechuanaland. Other new diseases were leaf spot of manna [*Setaria italica*] caused by *P. setariae*, grey leaf spot of rice (*Diplodia oryzae*), and poor seed set of rice in Natal due to *Phyllosticta glumarum*. *Puccinia polysora* again attacked maize on the Zululand coast; its southward extension appears to have ended. During the year the potato variety Pentland Ace containing the resistance gene R_3 was severely attacked by *Phytophthora infestans* in parts of the southern Cape, more so than the old standard variety Arran Chief. Race 3 of the fungus occurs in this region.

In further studies on the classification and identification of virus diseases of the Leguminosae common bean mosaic, yellow bean mosaic, a strain of lucerne mosaic, and an unnamed virus were found on beans [*Phaseolus vulgaris*], the yellow mosaic and lucerne mosaic occurring on several other species of legumes also. Two unidentified viruses were associated with cowpeas. Sunn hemp [*Crotalaria*] mosaic and lucerne mosaic were the principal viruses attacking sunn hemp [*C. juncea*] and lucerne, respectively. Common pea mosaic attacked peas, sweet peas, and probably lupins also. Most of these viruses were transmitted experimentally by the pea aphid (*Macrosiphum pisi*) [*Acyrthosiphon pisum*] or the groundnut aphid (*Aphis craccivora*). Following attack by rosette [virus: 33, p. 657] in the field groundnuts have shown at least five syndromes, viz. rosette (the commonest and most important), green rosette, mosaic, fleck, and vein-banding, all of which are reproduced unchanged after transmission by *A. craccivora*.

Grenadillas [*Passiflora* spp.] in Natal were severely affected by woodiness, brown

spot (*Alternaria tenuis*), and leaf, fruit, and stem spot (*Septoria passiflorae*). The two last-named fungi were controlled by fortnightly Bordeaux sprays. A bacterial wilt killed 75 per cent. of a castor oil [*Ricinus communis*] crop on the Natal south coast within a few weeks. Sulphur was as effective as the best mercurial dusts for seed treatment against covered smut (*Sphacelotheca sorghi*) [loc. cit.] of kaffircorn. Thiram and spergon were at least as good as these dusts on groundnut seed.

S. J. Du Plessis (pp. 96–100) states that since December, 1954, the inspection of potato seed tubers offered for certification by members of the ordinary potato seed growers' association has been assigned to the Department of Plant Control and Quarantine [cf. 35, p. 91]. Every effort was made to ensure that potato varieties susceptible to wart disease (*Synchytrium endobioticum*) were not planted in affected areas. Sugar-cane mosaic virus incidence was most severe in the south coast region, particularly in the vicinity of Umzinto and Esperanza. Chlorotic streak occurred throughout the humid areas but so far it appears to be of only minor importance. Smut (*Ustilago scitaminea*) damaged the variety Co. 301 in several places and N. Co. 310 and N. Co. 293 also, where there were abundant sources of infection. The planting of varieties highly resistant to mosaic virus rather than tolerant varieties is advocated, even if the former are of less agronomic value.

In the western Cape Province a plot was acquired for establishing a quarantine station where imported plants and those of particular economic importance can be tested in isolation. The demand for certification of plants and plant products has greatly increased, with excellent co-operation from exporters.

R. I. Nel, reporting on deciduous fruit research (pp. 132–136) states that the results of field spraying trials with various fungicides for the control of certain fruit diseases demonstrated that Bon Chrétien pear trees sprayed with lime-sulphur produced fewer fruit-buds than those sprayed with captan or glyodin. Glyodin is also safe for use on Beurré Hardy and most apples but causes leaf russeting on Beurré Bosc and Winter Nelis pears. Captan gave promising results against apricot brown rust (*Puccinia pruni-spinosae*) and gum spot (*Clasterosporium carpophilum*) [19, p. 418]. Improved control of the latter on peaches was secured with two applications of a copper-containing material, the first being applied at about 25 per cent. leaf fall and the second within three weeks of the first. Preliminary studies on the longevity of the vine bacterial blight organism (*Erwinia vitivora*) [35, p. 75] indicated that it does not survive for long in the petioles when both temperature and humidity are high.

R. H. Marloth, reporting on citrus and subtropical fruit research (pp. 137–141), states that stem-end decay of avocados during storage was shown to be due to *Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri*.

From the Transvaal region J. J. Theron (pp. 166–170) reports that the maize varieties Gobi yellow (flint), Kroonstad Ruby, Sahara, Potchefstroom Pearl, and Hickory King were highly resistant to *H. turcicum*. In experimental plots at the Agricultural Research Institute the Mexican inbred white maize lines Qro. V.-260–1–2–1, Gto. 29–157A–5–7–1, and Li–27–4–1 and the yellow dent line K.148 from Kansas were highly resistant to *H. turcicum* and brown rust (*Puccinia sorghi*), while the Mexican line Gto. 29–271–1–7 appeared to be practically immune.

A. R. Saunders reports from the Natal Region (pp. 171–175) that lettuce downy mildew (*Bremia lactucae*) was found for the first time in South Africa in a garden in Pietermaritzburg. Vine downy mildew [*Plasmopara viticola*: 28, p. 50], which has been observed in the Union from time to time but never in epiphytotic form, appears to be present on several varieties at different localities in and near Pietermaritzburg. *Necator decretus*, the imperfect state of *Corticium salmonicolor* [31, p. 460] was identified on apple branches at Hilton Road. This is the first record of the imperfect state in the Union. *C. salmonicolor* also occurred as a parasite on a wattle branch [*Acacia* sp.] in Pondoland.

Annual Report East African Agriculture and Forestry Organization, 1955.—114 pp., 1 pl., [? 1956].

This report [cf. *R.A.M.*, 34, p. 83] covers the period January 1954 to June 1955 inclusive. In the section dealing with American maize rust (*Puccinia polysora*) (pp. 43–46), much of the information on which has already been noticed in this *Review* [cf. 35, pp. 12, 277], H. H. Storey and Mrs. A. K. Ryland note that the juvenile reaction of newly-bred resistant lines correctly interprets their subsequent field behaviour.

Further work on virus diseases of sweet potato is reported by F[rances] M. L. Sheffield (pp. 46–48). Of a number of families of insects tested as vectors, only white flies transmitted the disease. In the course of experiments it became evident that climatic conditions have a considerable effect, not yet fully understood, on symptom expression, which may sometimes be marked. The feathery mottle virus, transmitted in America by *Myzus persicae* [34, p. 174], may be identical with a mild form found near Lyamungu, Tanganyika, on this host and transmitted by the same vector, in which it is non-persistent.

Mrs. A. K. Ryland reports (pp. 48–49) on investigations of a virus disease of strawberries in Kenya, the symptoms resembling the crinkle complex [cf. 34, p. 770]. Plants of the Cambridge Regent variety were found to be carrying one or more viruses that remained masked in Early Pine, and there are probably a number of viruses involved, imported in the past in strawberries from different sources, but it was not possible to analyse the components of the complex.

Frances M. L. Sheffield and G. A. Quinion give an account (pp. 98–101) of the new plant quarantine station [35, p. 544]. Early importations of ornamentals, to be screened for viruses, include chrysanthemums, dahlias, begonias, and arum lilies (*Zantedeschia* sp.).

In the section dealing with research by officers of the Tanganyika Agricultural Corporation (pp. 108–114) A. C. Evans reports that the groundnut variety Mwitunde has maintained its promise of controlling rosette disease and proved more resistant than the other long-season variety under trial, Kanyana. Investigations of *Cercospora* [*Mycosphaerella*: 17, p. 651] leaf spots of groundnut by J. S. Hemingway have already been noticed [35, p. 342]. The same officer reports that *P. polysora* is the most serious disease of maize in the Corporation's area. Experiments involving 'blanket' treatment with sulphur dust indicate a reduction of yield due to the disease amounting to 1,847 to 2,749 lb. per acre. The local variety Katumbibi is proving useful in breeding lines for resistance.

Annual Report on the Department of Agriculture, Gold Coast, for the year 1953-54.—30 pp., 1956.

In this report [cf. *R.A.M.*, 34, p. 518] it is stated that the coco-nut disease present at Keta, Gold Coast, resembles in its symptoms the bronze leaf wilt found in the southern Caribbean [35, p. 448], the cause of which is still unknown. The exact nature of the disease is unlikely to be discovered without more prolonged and detailed research than is possible locally.

It is now recognized that no rootstock can protect West Indian limes and grapefruit from the die-back virus present in the Gold Coast [33, p. 151], but the use of the Cleopatra tangerine as a stock for limes is advocated for the rehabilitation of areas where the disease has not become too prevalent. Coffee rust (*Hemileia vastatrix*) [34, p. 773] was recorded at Kpeve Agricultural Station, British Togoland, in 1953.

Department of Agriculture, Kenya, Annual Report, 1954.—Vol. II.—253 pp., 1955.

In the section (pp. 13–18) of this report [cf. *R.A.M.*, 35, pp. 276, 357] by the senior research officer (plant pathology), R. A. M. Nattrass states that an appar-

ently new disease of strawberries became serious in two localities in Kenya during 1954. The roots died and shrivelled from the tips, and a leaf necrosis spread backwards from the tips and margins across the lamina and down the petiole. No pathogen was isolated from the leaves, but the roots yielded a number of weakly parasitic soil fungi. The disease, which seems to resemble black root rot [cf. 33, p. 140], is attributed to conditions which promote an attack on the roots by fungi not normally parasitic. A bacterial disease of globe artichoke [*Cynara scolymus*], not previously recorded in Kenya, occurred on a five-acre plot on the shore of Lake Naivasha. Only the flower buds and heads were affected, particularly the involucral bracts, and it is assumed that infection occurred at the bud stage, when the tips of all the bracts were in contact. With very early infection the buds were killed and blackened to the base of the receptacle. The disease, which had no permanent effect on the plants, appeared to be due to a species of *Xanthomonas*.

An outbreak of antirrhinum rust (*Puccinia antirrhini*) [C.M.I. map No. 40] occurred in a park in Nairobi, in a nursery a few miles away, and on the shore of Lake Naivasha. *Elsinoe phaseoli* [No. 194] caused damage to *Dolichos lablab* south of Nairobi. Canadian Wonder beans [*Phaseolus vulgaris*] were attacked in several localities by *Ascochyta phaseoli* [*A.* ? *phaseolorum*: cf. *R.A.M.*, 30, p. 309]. Crown gall [*Agrobacterium tumefaciens*] continued to damage fruit trees, including apple, plum, and peach in various places; the galls are considered to exert a serious effect on the trees. The races of potato blight (*Phytophthora infestans*) so far identified in Kenya are A, C, D, G, and H [33, p. 215]. Tomatoes were everywhere severely affected by *P. infestans*.

In the report (pp. 64–66) of the plant pathologist (plant breeding), A. D. S. Duff states that owing to unfavourable growing conditions *Puccinia glumarum* was much more prevalent than usual in the lower wheat-growing areas and widespread in the higher; in the country as a whole it caused severe damage. The once highly resistant variety 341 was heavily attacked, indicating the existence of new strains of the rust. Foot rot of wheat (*Fusarium graminearum*) [*Gibberella zeae*: 33, p. 141] caused more damage than usual; mostly, it occurred in patches, but at Njoro, where wheat followed maize, the entire field was affected. Loose smut (*Ustilago tritici*) [30, p. 31] is not prevalent at present, but constitutes a menace; at the Plant Breeding Station a plot grown from Argentinian seed was severely infected. *P. graminis* and *P. coronata* were common on oats [35, p. 359]. Up to 40 per cent. of blind ears were present in some oat crops, but the cause was not determined. On maize *P. sorghi* [loc. cit.] occurred early in the season; *Helminthosporium turcicum* [loc. cit.] was troublesome in some crops.

In the report for the years 1952 and 1953 of the plant pathologist and physiologist, Coffee Services (pp. 98–111), R. W. Rayner concludes that there is reasonable evidence that spraying with copper against [physiological] leaf fall [35, p. 276] in May increases the length of life of mature leaf on the coffee bush unless the leaf is already very old. July spraying has the least effect, but it appeared to increase the life of 'long rains' leaf, though it may have decreased that of the previous 'short rains' leaf. September spraying had the greatest effect, prolonging the life of leaf formed just before the application by nearly two and a half months, a highly significant result. These results support the view that spraying should be carried out shortly before periods of natural leaf fall. The effects of spraying on yield closely agreed with those obtained for leaf fall, demonstrating that yield and leaf fall are related.

In co-operation with Pest Control, Ltd., a 'wheel-barrow' sprayer was designed for local manufacture, the pump being imported from England. The container consisted of a cut-down 44-gal. drum carrying up to 27 gals. of spray, mounted on a framework of $\frac{1}{2}$ in. piping and resting on a spindle with two small pneumatic-tyred wheels. The machine had two long handles behind and a single one with a

cross-bar in front, the latter hinged so that it could be folded upwards and backwards when not in use. The pump supplied two lances, each with two nozzles. The cost was about £45.

In 1953 coffee berry disease (*Colletotrichum coffeanum* var. *virulans*) [*Glomerella cingulata*: 32, p. 78] was much more widespread than in previous years, though not severe. If climatic conditions favourable to an outbreak, like those of 1951, were again experienced, much greater damage would be caused. The disease has now become established in the Upper Kiambu area. Thermophygrograph records kept at three sites on Kentmere Estate indicated that attacks are correlated with periods of temperature below 53° F., but not with periods of high humidity.

It was ascertained that free water must be present for infection of coffee leaves by *Hemileia* [*vastatrix*: 35, p. 276] to take place, and that in certain conditions the period of incubation in the leaves may last for five months.

In 1952 *Grevillea robusta* trees growing as coffee shade in Upper Kiambu developed a darkening of the crown foliage and were lacking in vigour. Progressive loss of leaf ensued, and die-back of the branches was followed by the death of the tree. In a fairly early stage of the condition the bark of the trunk darkened over a long, narrow area, and eventually a deep buff gum oozed out at places, turning chestnut brown as it congealed. The wood parenchyma and the parenchymatous cells of the medullary rays were crowded with gum globules. No fungal or bacterial organism appeared to be present.

Rapport annuel pour l'exercice 1954. [Annual report for the year 1954.]—*Publ. Inst. nat. agron. Congo belge, 1954* (hors sér.), 492 pp., 1 map, 1955.

In this report [cf. *R.A.M.*, 34, p. 583] it is stated that an epidemic outbreak of leaf spot on two- to four-year-old oil palms (*Cercospora elaeidis*) [34, p. 147; 35, p. 449] at Yangambi was controlled by spraying with 0·5 per cent. copper oxychloride after collecting and burning the withered leaves.

In one experimental field 9·75 per cent. of the *Hevea* rubber trees given [unspecified] treatment against [unidentified] root rots developed brown bast [34, p. 584], as against 13·45 per cent. of the untreated. Of 358 trees in which during a period of two years the flow of latex had become arrested, 118 recovered, 25 remained unchanged, 61 showed splitting of the bark, 46 developed nodules, and 108 died. Two years after planting the incidence of root rots in clearings subjected and not subjected to burning was 6 and 2·8 per cent., respectively. In another test, seven years after planting there was no difference in mortality from *Fomes lignosus* [loc. cit.] between the two types of clearing [cf. 35, p. 231].

Decay of the stumps of forest trees was more rapid in burned clearings than in those not burned. Six to eight years after tree felling stumps bearing sporophores of *F. lignosus* were most numerous in the latter, while in another experiment, two years after felling, they occurred more frequently in burned clearings. This may be due to a more rapid development of foci of infection in burned areas, where the soil temperature is higher. In the laboratory mycelial growth of *F. lignosus* was only one-fifth as extensive on *Hevea* rubber roots deprived of starch by ringing the tree or poisoning with sodium arsenite as on roots from felled trees.

Ten months after felling without poisoning the starch had disappeared from the tap roots, but was still abundant in the laterals. Poisoning the stumps with sodium arsenite eliminated the starch from the roots, most of which had died. Poisoning standing trees brought about the disappearance of the starch from the tap root and reduced it in the other roots; the aerial parts died, but the roots remained alive. Ringing had a similar effect, but the aerial parts were not killed. Poisoning the stumps is, therefore, the most effective method of controlling root rot. Against stripe canker [*Phytophthora palmivora*: 34, p. 584] preventive applications of 2 per cent. brunolinum and 0·25 per cent. tetradecyl piridinium bromide made twice

weekly during the afternoon of the day on which the trees were tapped were equally effective.

A plot of *Canavalia ensiformis* was somewhat seriously affected at the close of the growing period by *Elsinoe canavaliae* [19, p. 692].

Robusta coffee in the Eastern Province (Yangambi Research Station) was affected by an internal white rot of the trunk. From its cultural characteristics the pathogen appeared to be a species of *Fomes*, though no sporophores were found. It was manifest externally usually by the development of a canker with a smooth centre surrounded by concentric scars, sometimes near the base of a broken branch, a pruning wound, at the top of the trunk, or on a large branch. The internal decay took the form of a delignification of the wood; the cellulose was not affected. Plantings eight to ten years old appeared to be most susceptible, as did trees with only one trunk; the crown wilted progressively and had to be cut away below the diseased part. Treatment of wounds with a fungicide is recommended.

When maize was experimentally inoculated with *Puccinia polysora* [34, p. 583], the primary infections were more severe than natural ones. Fresh inoculations were then made by rubbing young healthy leaves with ripe spores from primary artificial infections on the same plants. Twelve days later secondary infections appeared, less numerous and less severe than the primary ones. In estimating susceptibility to *P. polysora* due allowance must be made for the different reaction of the plants when exposed to natural as distinct from artificial infection. Field observations indicated that susceptibility is individual rather than varietal, and is affected by soil factors.

Work at Mvuazi Station, Lower Congo, showed that grapefruit trees on their own roots were more tolerant of tristeza virus [35, p. 97] than grafted trees. Varieties locally resistant to canker [*Xanthomonas citri*: loc. cit.] are: Oneco and Satsuma mandarin; the common and Bouquetier de Nice sour oranges; Rough Lemon, Hertaciones, Lisbon, Eureka, Bernia, Corregia, Villa Franca, Genoa, and Limette lemon; Tahiti seedless lime; Spanish Lemon citron; and (possibly) the Canton Shaddock grapefruit. Psorosis virus [loc. cit.] was eradicated locally by cutting down all Washington Navel oranges.

In a test at Gandajika Experiment Station (Southern Sector) on the control of groundnut leaf spot (*Cercospora personata*) [*Mycosphaerella berkeleyii*: cf. 17, p. 651; 30, p. 196], plots of three varieties sprayed twice (with an interval of a fortnight) with 0·35 per cent. copper oxide or 1 per cent. Bordeaux mixture at 800 l. per ha. yielded 40 to 60 per cent. more than the unsprayed. Copper oxide gave better control than Bordeaux mixture throughout.

Investigations at Mulungu-Tshibinda Agricultural Research Station, Kivu Sector, showed that floral infection of pyrethrum (*Chrysanthemum cinerariifolium*) by *Ramularia bellunensis* [33, p. 756; 35, p. 358] increases steadily from January to April, then decreases rapidly from June to August. Production is less affected during the peak period (January and February) than subsequently. The flowers should be picked at least once every ten days. Wide spacing (60 by 60 and 50 by 50 cm.) appears to reduce infection, but the spacing generally adopted locally (45 by 60 cm.) is satisfactory. In a preliminary spraying test, six fortnightly applications to young seed-beds from February to May of a 50 per cent. solution of 0·25 per cent. copper oxychloride used at the rate of 840 l. per ha. increased yields by 20 per cent., as compared with the untreated controls.

Hofmann (K.) & Tausig (F.). **On the identity of phytomonic and lactobacillic acids. A reinvestigation of the fatty acid spectrum of Agrobacterium (Phytomonas) tumefaciens.**—*J. biol. Chem.*, 213, 1, pp. 425–432, 2 graphs, 1955.

The authors, working at the University of Pittsburgh, Pennsylvania, obtained significantly different results from those of earlier workers (*J. biol. Chem.*, 156, p.

101, 1944) as to the nature of the fatty acids of *Agrobacterium tumefaciens* [*R.A.M.*, 35, p. 513 and following abstracts]. The lipides, forming 7·5 per cent. of the dry weight of the cells of the organism, were found to contain 10 per cent. palmitic acid, 68 per cent. *cis*-vaccenic acid, and 13 per cent. lacto-bacillic acid; stearic acid could not be identified. The liquid-saturated fatty acid component previously called phytomonic acid was shown to be lactobacillic acid.

Braun (A. C.). **Studies on the nature of the cellular alteration in the crown gall disease.**—*Proc. second nat. Cancer Conf.*, pp. 1355–1364, 1 fig., 1 diag., [? 1954].

The writer describes the conclusions reached in work at the Rockefeller Institute for Medical Research, New York, concerning the nature of the initiation of cellular reactions to crown gall [*Agrobacterium tumefaciens*: see preceding and following abstracts] infection, which have already been noticed from other sources [*R.A.M.*, 34, p. 774; 35, p. 513].

Höhn (K.) & Dressler (H.). **Krebsdisposition und Wuchsstoffspiegel pflanzlicher Gewebe in verschiedenen Entwicklungsphasen.** [Tendency to crown gall and auxin level of plant tissues in various phases of development.]—*Beitr. Biol. Pfl.*, 32, 1, pp. 107–134, 8 graphs, 1955.

The essential information gained from this exhaustive study on the relation of the auxin level at various stages of growth to predisposition to crown gall (*Agrobacterium tumefaciens*) [cf. *R.A.M.*, 33, p. 470 and preceding abstract] in plant hosts has already been noticed from another source [35, p. 167].

Dorn (Martha). **Über den Einfluß phytopathogener Pilze auf die Entwicklung und Infektionskraft von drei Rhizobium-Arten.** [On the influence of phytopathogenic fungi on the development and infectivity of three *Rhizobium* species.]—*Zbl. Bakt.*, Abt. 2, 109, 5–8, pp. 120–139, 3 figs., 1 diag., 1956.

At the Institute for Microbiology, Uppsala, Sweden, the influence of eight plant pathogens and two non-pathogenic fungi on two strains each of *Rhizobium meliloti*, *R. trifolii*, and *R. leguminosarum* was studied in mixed cultures in a synthetic mineral solution favourable to both groups of organisms, supplemented by plate tests on a solid medium, using mycelial suspensions and concentrated culture filtrates of the fungi. The effects of sterile fungal filtrates on nodule production and infectivity in the bacteria were also investigated *in vivo*.

In the *in vitro* tests *Fusarium lini*, *F. culmorum*, *Sclerotinia trifoliorum*, and the saprophytic *Pyronema confluens* and *Penicillium* sp. inhibited the growth of all three *R.* spp. The antagonism of *S. trifoliorum* was in all probability associated with its copious production of acid in culture. *Helminthosporium gramineum* and *Fusarium nivale* [*Calonectria nivalis*] stimulated the development of *R. meliloti* and the latter fungus acted similarly on *R. leguminosarum*. *Ascochyta imperfecta* scarcely interfered with the growth of the nodule bacteria, while the results obtained with *A. pinodella* and *A. pisi* were inconsistent.

The results of tests on lucerne confirmed the inaction of *A. imperfecta* and the stimulus to growth afforded by *H. gramineum* and *C. nivalis* in mixed cultures, but were conflicting in the case of *S. trifoliorum*, which did not reduce nodule formation. Further studies are planned by a method involving direct observation of the nodules in the course of production.

Wood (R. K. S.). **Studies in the physiology of parasitism XVIII. Pectic enzymes secreted by Bacterium aroideae.**—*Ann. Bot., Lond.*, N.S., 19, 73, pp. 1–27, 1 diag., 3 graphs, 1955.

In further studies in this series at the Plant Pathology Laboratory, Imperial College, London [cf. *R.A.M.*, 35, p. 385], a strain of *Bacterium carotovorum*

[*Erwinia carotovora*] known as *E. aroideae*, which produced a rapid soft rot of potato tubers, was grown in a simple, synthetic liquid medium. Cell-free filtrates contained an enzyme [cf. 34, p. 667], provisionally termed depolymerase, which rapidly reduced the viscosity of pectin solutions, and protopectinase which macerated slices of potato tuber tissue [loc. cit.]. These filtrates had little pectin-esterase activity. Enzyme preparations which rapidly reduced the viscosity of pectin and pectate solutions were relatively inactive when assayed for polygalacturonase activity by measuring the reducing groups liberated. Depolymerase was rapidly inactivated at temperatures above 60° C. and at pH 2·7. In general its properties resembled those of protopectinase.

Tešić (Ž. P.). **Fitopatogene bakterije u klasifikaciji bakterija N. A. Krasiljnikova.** [Phytopathogenic bacteria in the classification of bacteria by N. A. Krasil'nikov.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 32, pp. 87–92, 1955. [English summary.]

The author discusses the treatment of phytopathogenic bacteria in N. A. Krasil'nikov's 'Handbook for the determination of bacteria and actinomycetes' (830 pp.) published in 1949 by the Microbiological Institute of the Academy of Sciences in Moscow, U.S.S.R. The total number of phytopathogenic species is reduced from 250 to 100, the remaining 150 being treated as subspecies or varieties. In the present article a list is given of these species with the reduced species in brackets.

The author disagrees with the transfer of *Corynebacterium insidiosum* and *C. michiganense* to *Mycobacterium*. The new genus *Pseudobacterium*, erected to accommodate the remaining plant pathogenic corynebacteria, is considered less suitable than the genus *Aplanobacterium*. Practically all the rest of the plant pathogens are placed in *Pseudomonas*; *Bacterium* includes former *Erwinia* spp. except for a few, e.g., *E. vitivora*, *E. cassavae*, and *E. lathyri*, which are included in *Chromobacterium*.

Posnette (A. F.) & Todd (J. M.). **Virus diseases of Cacao in West Africa. IX. Strain variation and interference in virus 1A.**—*Ann. appl. Biol.*, 43, 3, pp. 433–453, 2 graphs, 1955.

This further account of work at the West African Cacao Research Institute on cacao swollen shoot virus [*R.A.M.*, 31, p. 427; 35, p. 168] deals with the variations of the different strains of virus 1A in their virulence on cacao and the possible practical applications of this. Outbreaks of swollen shoot are usually due to several strains, and individual trees are often infected simultaneously by more than one, as is demonstrated by coppicing trees or by inoculations with grafts from different parts of one tree. No evidence was obtained, however, that either mild or virulent strains are consistently dominant in the roots or other parts of cacao trees. No treatment was found which attenuated the virus, though tests were made of the effects of darkness, high temperature, chemicals, host nutrition, and different host species. Coppicing probably enables mild strains, present in many infected trees, to become dominant, sometimes temporarily, over more virulent strains.

Cacao trees infected with mild strains were usually protected against the effects of infection by virulent strains, but virulent strains entered plants already infected with mild strains, though usually no symptoms were produced unless the trees were coppiced; the severe symptoms that then appeared on the new growth were seldom repeated in later growth. Trees with dominant mild strains are probably not more common in outbreaks of the disease because the mild strains are less readily transmitted by vectors than are the virulent ones. Mealybugs (*Pseudococcus njalensis*) transmitted the virulent strains from leaves displaying symptoms characteristic of such strains, but not from leaves without these symptoms, suggesting that the multiplication of a virulent strain is impeded in plants infected with a mild strain.

In field experiments artificial infection with a mild strain protected mature trees against the effects of virulent strains spread naturally by mealybugs. In a period of three years 273 of 387 previously healthy trees became severely infected in the control plots, whereas only 35 of 416 trees already infected by grafting with the mild strain developed symptoms of infection by the virulent strain. Five years after infection with the mild strain, yields were one pod per tree more than in the year of inoculation, though the decrease on trees infected with the virulent strain was 16 pods per tree.

Inoculation of cacao trees with mild strains to protect them against the effects of virulent strains should be considered only if the disease is endemic and if (for political or other reasons) it is impossible to eradicate it. In addition, spread must be rapid enough to constitute a danger to healthy farms, and losses so heavy that the reduction in yield from the mild infection, even if it persists over a long period, is a preferable alternative.

The possibility that a virulent mutation may arise from the strain used for protective inoculation cannot be overlooked. The apparent changes in virulence often observed seem, however, to be due to changes in the relative dominance of different strains in individual plants. Virulent strains appear to survive because they are readily transmitted by vectors, and mild ones because they persist indefinitely in a host by protecting it from destruction by virulent strains. The danger of a change from mild to virulent in a strain selected for field protection appears to be slight.

That protection may fail is a serious objection, and the 35 'protected' mature trees which developed severe symptoms provide an example of failure, due, perhaps, to the mild strain not becoming systemic. It seems that when protection is complete the challenge virus is lost, though it can enter pre-infected plants through a graft and remain latent for many months, its presence being demonstrated by coppicing. The results obtained so far suggest that young plants infected with a mild strain would seldom become reservoirs of virulent strains, but there is some conflicting evidence on this point, and before the available information can be explained further experiments must be made in which super-infected trees are tested at intervals to follow the course of infection and ascertain to what extent protecting and challenging strains become systemic. It must also be borne in mind that the use of mild strains of virus 1A on a field scale would not afford protection against other viruses and might increase the injurious effects of any such that invaded 'protected' plants.

Until fully resistant material becomes available, 'protection' would be of most value in replanting areas where the rate of infection from wild hosts or diseased cacao has become so high that many young trees have to be destroyed before yielding an economic crop. Protective inoculation, even if it merely retarded the spread of virulent strains, would then seem to be of potential value, but mild strains cannot be considered for field use until selected both for their ability to suppress virulent strains and for their effect on yield.

Sakurai (Y.) & Matuo (T.). **The response of Graminaceous crops to the white root rot fungus, Rosellinia necatrix (Hart.) Berl.**—*Res. Rep. Fac. Text. Seric., Shinshu Univ.*, 4, pp. 13–16, 2 figs., 1954. [Japanese with English summary.]

When wheat, barley, maize, and sorghum were grown in pots in soil infected with *Rosellinia necatrix*, some of the maize and sorghum plants showed signs of attack by the fungus, but the wheat and barley appeared unaffected, though some infection, very slight in wheat, had occurred in the roots. The resistance of the wheat was not due to lignification or callus formation, but to some unknown physiological characteristic.

Glynne (Mary D.). **Soil-borne diseases of cereals.**—*J.R. agric. Soc.*, 115, pp. 41–46, 4 figs., 1954.

The information in this account of soil-borne cereal diseases in Britain has mostly been noticed already in this *Review*. The diseases dealt with are take-all (*Ophiobolus graminis*) and eyespot (*Cercosporella herpotrichoides*) and the effect upon them of various cultural practices [cf. *R.A.M.*, 35, p. 152 and above, p. 586], sharp eyespot (*Corticium solani*) [22, p. 426], and brown foot rot (*Fusarium* spp.) [18, p. 446].

Cummins (G. B.) & Caldwell (R. M.). **The validity of binomials in the leaf rust fungus complex of cereals and grasses.**—*Phytopathology*, 46, 2, pp. 81–82, 1 fig., 1956.

Since the International Code of Botanical Nomenclature now excludes names based on the uredial state, the authors have examined the nomenclature of the brown rust fungus of cereals and grasses [*R.A.M.*, 12, p. 499]. Only two names, *Puccinia elymi* [4, p. 213] and *P. recondita*, are validly published. The former has rostrupioid spores and is, therefore, considered distinct from the brown rust fungus, which has bicellular teleutospores. *P. recondita* is considered to be the obligatory name for the rye brown rust as the type material (rye) has bicellular teleutospores. This is the oldest valid binomial applicable to the '*rubigo vera*' complex, *P. rubigo-vera*, *P. dispersa*, and *P. triticina* being later homonyms.

Nelson (R. R.), Wilcoxson (R. D.), & Christensen (J. J.). **Heterocaryosis as a basis for variation in Puccinia graminis var. tritici.**—*Phytopathology*, 45, 12, pp. 639–643, 2 figs., 1955.

In studies at the Minnesota Agricultural Experiment Station to determine the possible relation of heterocaryosis to variation in wheat stem rust (*Puccinia graminis*) [cf. *R.A.M.*, 27, p. 127 *et passim*], uredospores of two or more biotypes from different physiologic races were mixed by hand and dusted on varieties susceptible to all the races in the mixture or resistant to one or more, represented by Little Club wheat and Khapli emmer, respectively. The first generation of uredospores from the former were transferred to resistant varieties. One biotype, originating from a mixture of biotypes of races 38 and 56, was highly pathogenic to Khapli, hitherto very resistant to all known North American races of *P. graminis*. However, after several uredo generations on Khapli the virulent heterocaryon became unstable and gradually lost its pathogenicity to that variety, which after 25 uredial generations developed only a type-1 (resistant) reaction. Isolations from single uredosori of such infections resulted in the recovery of both biotypes, together with two new races, A and B, each carrying some of the pathogenic attributes of both parents. For instance, Marquis was as susceptible to both A and B as to race 56, while the mesothetic reaction of Mindum and Spelmar was the same as that normally induced by 38. The new races A and B differed in their effects on Kubanka, Acme, and Einkorn, while both were more virulent on Arnautka than either of their progenitors.

Some of the uredospores, pedicels, and hyphal cells of the virulent biotype were tri- or quadrinucleate. The percentage of multinucleate cells and spores varied among isolates of the heterocaryon after 15 uredo generations and also within a single isolate from one generation to another. The original and new biotypes produced only binucleate uredospores and did not dissociate.

Wheat stem rust. New weapons sought to back up traditional genetic approach.—*J. agric. Food Chem.*, 4, 2, pp. 103–104, 106, 1 fig., 1956.

During the decade ending in 1950 only four of the roughly 230 known races of wheat stem rust [*Puccinia graminis*: see preceding abstract] were widespread in North America and the disease was essentially under control. By 1952, however,

race 15 B [*R.A.M.*, 35, p. 5], which began to spread suddenly in 1950, had become predominant, while by 1954 some of the older races had resumed a threatening aspect. The breeding of resistant varieties is a lengthy process, and not until the winter of 1953–4 did Selkirk [35, p. 157] become available commercially. At the present time there are perhaps 1,500,000 to 2,000,000 bush. of this variety on the United States market, while the North Dakota Agricultural Experiment Station has released other varieties. In 20 field tests in Manitoba and North Dakota during 1955 on the use of chemicals for control [35, p. 172], yield increases up to 10 bush. per acre were secured by two to four applications at 10-day intervals from the 'boot' to the soft dough stage of 2 qts. nabam plus ½ lb. zinc sulphate and ¾ oz. spreader-sticker, or of zineb alone in 25 gals. water. For the moment, however, this promising method of control is impracticable on various grounds, such as high cost and phytotoxicity.

Hassebrauk (K.) & Kaul (R.). **Vergleichende Untersuchungen über die Säuren und Zucker des Grundstoffwechsels an Weizensorten unterschiedlicher Rostanfälligkeit.** [Comparative studies on the acids and sugars in the basal metabolites of Wheat varieties differing in susceptibility to rust.]—*Naturwissenschaften*, 43, 2, p. 40, 1 fig., 1956.

A summary is presented of studies at the Institute for Physiological Botany, Brunswick, Germany, to determine the physiological basis for resistance to yellow rust [*Puccinia glumarum*], in wheat. The results of analyses on eight- to 14-day old seedlings of the resistant Chinese 166 variety showed that it contained small quantities of malic, oxalic, citric or isocitric, ascorbic, and various inorganic acids. There was no difference in respect of the glucose, fructose, and maltose contents between Chinese 166 and the susceptible Michigan Amber.

Kobel (F.). **Zur Nomenklatur des Zwergbranderregers.** [On the nomenclature of the incitant of dwarf bunt.]—*Phytopath. Z.*, 26, 1, pp. 31–34, 1 graph, 1956. [English summary.]

The results of comparative studies at the Federal Agricultural Experiment Station, Zürich, on collections of *Tilletia brevifaciens*, *T. controversa*, and *T. secalis* (from rye), all from Switzerland [*R.A.M.*, 35, p. 274], revealed no significant differences in spore measurements between the two first-named, whereas those between these two and *T. secalis* were significant. The spore diameters (including the ridges) of the three species were 19·9±0·73, 20·2±0·96, and 20·9±0·72 μ, respectively.

In cross-inoculation experiments *T. brevifaciens* from wheat failed to infect *Agropyron intermedium*×*A. litorale*, while *T. controversa* from the *Agropyron* hybrid was unable to attack wheat; on the other hand, each was pathogenic to its own host [cf. 34, pp. 221, 358, *et passim*].

On the basis of these investigations it is proposed to refer the agent of wheat dwarf bunt to *T. controversa*, which should, however, be subdivided into formae speciales, e.g., *T. c. tritici* and *T. c. agropyri* for the strains attacking wheat and *Agropyron*, respectively.

Niemann (E.). **Stimulationswirkung von Düngemitteln und quecksilberhaltigen Beizmitteln auf die Sporenkeimung des Zwergsteinbrandes (Tilletia controversa Kühn).** [The stimulating effect of fertilizers and mercurial dressings on the spore germination of dwarf bunt (*Tilletia controversa* Kühn).]—*Angew. Bot.*, 30, 1–2, 13 pp., 5 figs., 1 diag., 2 graphs, 1956.

In further work in this series [*R.A.M.*, 34, p. 357] at the Kiel-Kitzeberg branch of the German Biological Institute, 13 mercurial or organic seed dressings and seven fertilizers were examined to see whether they would stimulate spore germination of *Tilletia controversa* on soil extract agar in subdued light [loc. cit.]. After 33 days

the seeded plate was streaked with the substance under test, mixed with talc to make it plainly visible, at one side of a cut dividing the agar into two parts. The spores in the streaked part were exposed to the action of the substances either by diffusion through the agar or by its vapour. The spores in the part separated by the cut were exposed to the vapour alone.

Two aliphatic seed dressings (containing mercury in the form of silicate) and mercuric chloride clearly stimulated germination in the vapour phase, though they were slightly inhibitory by diffusion. Among the fertilizers, nitrophoska, ammonum sulphate, and calcium ammonium nitrate stimulated germination, while causing no inhibition by direct contact or diffusion.

It is apparent that fertilizers or seed dressings on treated seed may under suitable circumstances stimulate the germination of spores in infected soil, and so give rise to infection. This has already been noted in the field [31, p. 547].

Fadrhons (J.). Селекция Пшеницы на устойчивость против головни вонючей. [Selection of Wheat for resistance to bunt.]—Соц. сельскохоз. Науку, Сер. A (*Socialist. agric. Sci., Czechoslovakia*, Ser. A), 4, 2, pp. 142–155, 3 figs., 1955. [German summary.]

In 1952 and 1953 winter and spring wheat hybrids and selections were tested by seed inoculation in Czechoslovakia for resistance to bunt (*Tilletia tritici*) [*T. caries*: *R.A.M.*, 30, p. 516]. Of the winter varieties, the wheat and couch grass [*Agropyron* sp.] hybrid No. 599 showed least infection (6 and 12 per cent. infected ears for the two years, respectively) and of the spring varieties, Hope (a cross between common wheat and *Triticum durum*) was without infection in Czechoslovakia in both years. The two varieties show promise and should be included in further hybridization work, both being also resistant to loose smut (*Ustilago tritici*) [30, p. 31].

Bubentsov (S. T.) & Slutch (A. S.). Термический метод борьбы с пыльной головней Пшеницы. [Hot water treatment method of controlling loose smut of Wheat.]—Земледелие [*Zemledelie, Moscow*], 4, 1, pp. 97–98, 1956.

Experiments at the Karaganda Agricultural Experiment Station, Kazakh, U.S.S.R., showed that when treating wheat seed with hot water against loose smut [*Ustilago tritici*: *R.A.M.*, 35, p. 93] and covered smut [bunt: *Tilletia caries*: loc. cit.] climatic conditions of the region where the seed is to be grown should be taken into consideration in order to obtain complete control. Thus, under local conditions the usual time required for the preliminary treatment of seed in warm water (28° to 32° [C.]) should be increased from four to five hours and the temperature of the succeeding hot-water treatment raised to 54° from 52° to 53°. Grain should then be cooled in cold water and allowed to dry under natural conditions.

In experiments in 1954 and 1955 loose smut was practically absent from plots with treated seed, there being only one or two infected ears per 15 to 20 ha. plots as against 1·2 to 4 per cent. infection in the controls.

Holton (C. S.) & Purdy (L. H.). **Comparative effectiveness of hexachlorobenzene (HCB) and mercury preparations in controlling soil-borne common bunt in commercial field trials.**—*Plant Dis. Reptr*, 39, 11, pp. 842–843, 1955. [Photo-offset.]

In co-operative field trials on two farms near Helix, Oregon, seed treatment of wheat on a commercial scale with anticarie and no-bunt (both 40 per cent. hexachlorobenzene) at 1 oz. per bush. effectively controlled soil-borne infection by *Tilletia caries* and *T. foetida* [*R.A.M.*, 34, p. 360 and following abstracts]. The average bunt percentages for the two preparations, respectively, were 2·8 and 0·3 as against 15·7 for ceresan M (1¼ oz.) and 5 per cent. for panogen (1 oz.).

PURDY (L. H.). **Regional seed treatment tests for the control of seed-borne and soil-borne common smut of winter Wheat in the Pacific Northwest.**—*Plant Dis. Reptr*, 39, 11, pp. 844–849, 1955. [Photo-offset.]

In the 1955 seed-treatment trials in ten regional nurseries in five Pacific Northwest States for the control of bunt (*Tilletia caries* and *T. foetida*) [see preceding and next abstracts] on Rio hard red and Orin soft white wheat the following fungicides gave an average of less than 1 per cent. bunted heads as against 84·5 per cent. for the untreated: dow HCB (1 oz. per bush.), sanocide (1), no bunt (1), anticarie (1), ceresan M ($\frac{1}{2}$), puratized C 13–1212 ($\frac{1}{2}$), and ceresan M-2×($\frac{1}{4}$), all slurries, velsicol (50–CS–46) liquid and slurry ($\frac{1}{2}$), the liquid mercury preparations 244 ($\frac{3}{4}$) and 364 ($\frac{1}{2}$), MEMA ($\frac{1}{2}$), tag # 331 ($\frac{1}{2}$), panogen 15 ($\frac{3}{4}$), and panogen 42 (0·2), all liquids. Mer-lin 1–37 ($2\frac{2}{3}$) was effective in the dry form but not as a liquid.

Soil-borne infection in inoculated soil was reduced from 55·3 per cent. (untreated) to less than 10 per cent. by captan HCB 50–20 (1 and 2), no bunt ($\frac{1}{2}$, 1, and 2), sanocide ($\frac{1}{2}$, 1, and 2), terraclor (1 and 2), anticarie ($\frac{1}{2}$, 1, and 2), and dow HCB (1 and 2), all slurries, and combined seed- and soil-borne infection from 80·1 per cent. (untreated) to under 10 per cent. by the same treatments except captan HCB at 1 oz. and sanocide at $\frac{1}{2}$. Mercury seed treatments were on the whole ineffective against soil-borne infection.

PURDY (L. H.). **Comparative phytotoxicity of seed treatment fungicides used for wheat smut control in the Pacific Northwest.**—*Plant Dis. Reptr*, 39, 11, pp. 850–852, 1955. [Photo-offset.]

In connexion with control of wheat bunt (*Tilletia* spp.) in the Pacific Northwest [see preceding abstracts] studies were made on the phytotoxicity of the standard seed-treatment preparations anticarie, agrox, ceresan M (all slurries), and panogen 15 (dilute form) [cf. *R.A.M.*, 34, p. 361]. Applications were made at the commercial rates ($\frac{1}{2}$ oz. per bush. for the first three products and $\frac{3}{4}$ for panogen 15) and at seven higher rates (up to 10 oz.) on the winter wheats Elmar, Brevor, and Rio and the spring Idaed, Baart, Federation, and Marfed. Treated seed was kept in paper bags for ten days or longer before sowing in the field and greenhouse. Agrox, ceresan M, and panogen 15 at more than 1 oz. were generally phytotoxic, as measured by stand reduction, on the three winter wheats and on Federation. The degree of phytotoxicity increased proportionately with the higher rates of application. Anticarie was practically non-phytotoxic at all the rates. None of the treatments increased the stand appreciably over the untreated.

These results do not substantiate a previous report indicating a differential phytotoxicity among the mercury compounds (*Phytopathology*, 44, p. 503, 1954).

SHIRKO (V. N.). Корневая гниль озимой Пшеницы **(Ophiobolus graminis Sacc.)** в увлажненных районах СССР и биологическое обоснование мероприятий по ликвидации очагов заболевания. [Root rot of winter Wheat (*Ophiobolus graminis* Sacc.) in wet areas of the U.S.S.R. and bioecological basis of measures for the elimination of infection sources.]—15 pp., Thesis, Pan-Soviet Scientific Research Institute of Plant Protection, Leningrad, 1950.

A description is given of take-all disease (*Ophiobolus graminis*) [cf. *R.A.M.*, 34, p. 576] and its occurrence on winter wheat in the U.S.S.R. Investigations from 1940 to 1949 showed that it can cause serious losses in some years and can affect 170 species of grasses and cereals, including *Lolium perenne*, *Agropyron cristatum*, *Agrostis alba*, and *Setaria glauca*, all of which serve as reservoirs of infection. Control measures include thorough autumn ploughing, improvement of soil structure by planting perennial grasses, seed sterilization, prevention of weed development, correct crop rotation, fertilization, and use of resistant varieties.

Sabet (K. A.). **On the sources and mode of infection with the yellow slime disease of Wheat.**—*Bull. Fac. Agric. Cairo Univ.* 42, 15 pp., 5 pl., 1954. [Received 1956.]

In pot studies at the Department of Agricultural Botany, University of Cairo, on the mechanism of infection of wheat by *Corynebacterium tritici* and its association with eelworms (*Tylenchus* [*Anguillulina*] *tritici*) [*R.A.M.*, 34, p. 634 and next abstract] pricking the germinating grains or wounding the seedlings prior to inoculation to simulate eelworm injury failed to increase the incidence of infection. The author suggests that the eelworms carry bacteria from the soil to the receptive region between the leaf sheaths and the stem of the seedling. Once infection is initiated it develops independently of eelworm movement, the spread of the bacteria being assisted by the elongation of the plant parts. Inoculation of older plants by placing slime between a leaf sheath and the stem produced only temporary, local lesions.

Infection generally occurs in the soil at the seedling stage. Aerial infection appears unlikely. Severely infected seeds are not viable, but any that are slightly affected may germinate and carry the disease over to the next season, the presence of eelworms increasing the incidence of infection.

The period of survival of the bacterium in the soil was increased when it was grown in sterilized soil and reduced by successive sowing of wheat; infection was highest in the first two months after soil inoculation and negligible after a year.

Sabet (K. A.). **Pathological relationships between host and parasite in the yellow slime disease of Wheat.**—*Bull. Fac. Agric. Cairo Univ.* 43, 10 pp., 3 pl., 1954. [Received 1956.]

In further investigations at Cairo University on the host-parasite relationship in the yellow slime disease of wheat (*Corynebacterium tritici*) [see preceding abstract], the bacterium was found on all external parts of affected plants, but rarely in the tissues. When the plant matures multiplication ceases on the exposed parts, and is then confined to the moist inner surface of the leaf sheaths. The bacterium may be present in the ovule cavity and both on and within the seeds.

Kantack (E. J.). **Chemical control of the Wheat curl mite, Aceria tulipae (K.), a vector of Wheat-streak mosaic.**—*Diss. Abstr.*, 15, 8, p. 1285, 1955.

Thirty chemicals were screened in the greenhouse and field at Kansas State College during spring, 1954, followed by aerial sprays on field-sown winter wheat in the two- to three-leaf stage, together with seed treatment with six systemic toxicants (blended with the carrier carbowax 6000) for control of the wheat curl mite, *Aceria tulipae*, the vector of wheat streak mosaic virus [*R.A.M.*, 34, p. 588]. In field studies 92 per cent. control was secured but the effect on wheat streak mosaic is not recorded.

Parmentier (G.). **L'inoculation monospore d'Erysiphe graminis (DC.).** [Single-spore inoculation with *Erysiphe graminis* (DC.).]—*Parasitica*, 10, 4, pp. 117–119, 1954.

A new method of effecting single-spore inoculations with *Erysiphe graminis* [cf. *R.A.M.*, 19, p. 205] is described from the State Phytopathological Station, Gembloux, Belgium. A seed of barley or wheat is halved and the embryo half sown in a glass tube 180 mm. long and 18 mm. wide, containing a mixture of leaf-mould and black soil and stoppered with a plastic square. A dwarf plant is thus produced as the tubes are too short for one of normal size. The incubation chambers are illuminated for 16 of every 24 hours by fluorescent tubes giving about 5,000 lux, the temperature within being about 25° C. during the period of illumination and about 12° at the end of the dark period. When the seedlings have developed a leaf

5 cm. long, they are inoculated by transferring a dry spore with a dry needle to the untreated leaf blade. By this means the author obtained 20 per cent. positive results with *E. graminis* f. *hordei* and f. *tritici*.

YAMADA (W.) & SHIOMI (T.). **Studies on the Rhynchosporium scald of Barley. I. General consideration of the disease and the causal fungus, and on the varietal resistance of Barley to the disease.**—*Spec. Bull. Okayama Prefect. agric. Exp. Sta.* 50, pp. 212–232, 2 pl., 1954. [Japanese, with English summary.]

Barley scald (*Rhynchosporium secalis*) [see below, p. 623] causes losses of up to 30 per cent. in the northern part of the Okayama prefecture, Japan. The optimum temperature for conidial germination and mycelial growth in culture is 20° C. but the fungus is killed by exposure to 35° for five days. In field tests of 300 barley varieties grown in Japan the American Coast and Brome were the most resistant.

FUTRELL (M. C.) & RIVERS (G. W.). **The effect of temperature on the response of Oats to race 216 of crown rust.**—*Plant Dis. Reptr*, 39, 11, pp. 853–858, 2 figs., 1955. [Photo-offset.]

When 51 southern oat varieties were tested in the seedling stage in the greenhouse at the Texas Agricultural Experiment Station, College Station, for reaction to race 216 of crown rust (*Puccinia coronata*) [*R.A.M.*, 34, p. 31; 35, p. 363], most of the Victoria derivatives showed more resistance at 65° F. than at 85°. The selection (Arlington-Delair)×Trispernia (C.I. 6908) was susceptible at 85° and highly resistant at 65° in January; later in the season, with increase in light intensity and length of day susceptibility at 85° decreased. The moderate resistance of Victoria derivatives at 65° during the winter may reduce the overwintering of the rust in areas where lower temperatures prevail and thus account for the absence of severe infection on these varieties early in the season.

TVEIT (M.). **Isolation of a chetomin-like substance from Oat seedlings infested with Chaetomium cochlioides.**—*Acta Agric. scand.*, 6, 1, pp. 13–16, 1956.

It was shown by work at Rutjers University, New Jersey, that an antibiotic substance chetomin is produced by *Chaetomium cochlioides* [*R.A.M.*, 35, p. 83]. A similar substance is also present in oat plants up to six weeks old grown from seed infested by a strain of the fungus producing it strongly. It remains to be proved that the substance isolated from the seedlings is identical with chetomin as produced by the fungus in culture.

GJERSTAD (G.) & RAMSTAD (E.). **Influence of certain chemicals on the growth and alkaloid formation of Claviceps purpurea (Fries) Tulasne in artificial culture.**—*J. Amer. pharm. Ass.*, 44, 12, pp. 731–740, 1955.

Although *Claviceps purpurea* [*R.A.M.*, 35, p. 521 and next abstract] made good growth on a synthetic medium at the School of Pharmacy, Purdue University, Lafayette, Indiana, no alkaloids could be detected in the broth or mycelium even after the addition of rye or rye flower extracts or of indole-3-methanol, indole-3-acetic acid, tryptamine, and tryptophane, which might, on the basis of structural analogy, act as precursors of lysergic acid.

RAMSTAD (E.) & GJERSTAD (G.). **The parasitic growth of Claviceps purpurea (Fries) Tulasne on Rye and its relation to alkaloid formation.**—*J. Amer. pharm. Ass.*, 44, 12, pp. 741–743, 3 figs., 1955.

After infection with *Claviceps purpurea* [see preceding abstract], the ovary of the rye flower is detached from the receptacle and remains at the apex of the developing sclerotium, which normally contains alkaloids from the inception of its formation. However, the soft, moist, small, aberrant sclerotia which occasionally develop

on rye and consist of septate hyphae contain no akaloids. Pigmentation appeared from these observations to bear no relation to alkaloid production. It is concluded that ergot alkaloids originate solely in sclerotial tissue.

Rumyantsev (P. D.). Меры борьбы с болезнями и вредителями зерна Кукурузы при хранении. [Control measures against diseases of pests of Maize grains during storage.]—Земледелие [*Zemledelie, Moscow*], 3, 10, pp. 81–87, 2 figs., 1955.

The following diseases of stored maize [see next abstract] in the U.S.S.R. are described: dry rot or fusariosis [*Fusarium* sp.], red rot [? *Gibberella zeae*: cf. *R.A.M.*, 34, pp. 705, 780], nigrosporosis [*Nigrospora* sp.], and diplodiosis [*Diplodia* ? *zeae*: cf. 15, p. 574]. Control is attained by rapid harvesting, thorough drying of the grain, allowing up to 14 or 15 per cent. humidity, and proper storage at temperature of 15° [C.] or less. Regular checking of stored maize should be carried out once every five days where temperatures rise above 10°, once every ten days at 5° to 10°, and twice a month at less than 5°.

Nemlienko (F. E.) & Kulik (T. A.). Болезни Кукурузы и основные приемы борьбы с ними. [Diseases of Maize and basic methods for their control.]—Земледелие [*Zemledelie, Moscow*], 3, 12, pp. 77–81, 1955.

Blister smut [*Ustilago maydis*: *R.A.M.*, 21, p. 12] and loose smut [*Sphacelotheca reiliana*: 15, pp. 360, 400], fusariosis [*Fusarium* sp.], white mould [5, p. 733], nigrosporosis [*Nigrospora* sp.: see preceding abstract], bacteriosis [30, p. 564] due to *Bacillus mesentericus vulgatus*, and [unspecified] moulds are stated to be widespread on maize in the U.S.S.R. and reduce yields. Blister smut is particularly destructive in the northern Caucasus, the central black soil belt, and the steppes, while nigrosporosis affects up to 25 per cent. of the plants in the Dnepropetrovsk region. Seed treatment with granosan (1 kg. per ton of seed) prevents mould infections which often invade seeds sown too soon or subjected to cool weather. Control measures in general include selection of healthy seeds, removal and destruction of smut balls during the growth period, removal of plant debris from the field, autumn ploughing, and timely sowing and harvesting.

Maramorosch (K.). **The occurrence of two distinct types of Corn stunt in Mexico.**—*Plant Dis. Reptr*, 39, 12, pp. 896–898, 2 figs., 1955. [Photo-offset.]

During a field survey in Mexico in the summer of 1955 the presence of two distinct types of maize stunt virus [*R.A.M.*, 32, p. 607], the Rio Grande [24, p. 498] and the Mesa Central, was established. The more severe Mesa Central type, until recently considered as the only one occurring in Mexico, is distinguished from the Rio Grande by the more continuous streaks; chlorotic spots are less conspicuous or are absent and there is usually no discoloration at the base of newly developed leaves. Considerable reddening and a deep purple colour often develop in older leaves and the affected plants are more stunted. This type of stunt occurs in the Central Plateau and has recently been observed for the first time on the Pacific Coast near Puerto Marquez. The Rio Grande type is found in the north near Cindad Victoria, in the south near Oaxaca, and around Veracruz.

Preliminary field observations indicated that the milder strains of both the types occur in Mexico.

Safeeulla (K. M.) & Thirumalachar (M. J.). **Periodicity factor in the production of asexual phase in Sclerospora graminicola and Sclerospora sorghi and the effect of moisture and temperature on the morphology of the sporangiophores.**—*Phytopath. Z.*, 26, 1, pp. 41–48, 5 figs., 1956. [German summary.]

The results of previous investigations on periodicity in relation to the production

of sporangia by *Sclerospora graminicola* and *S. sorghi* indicated that their nocturnal development in the field [*R.A.M.*, 3, p. 718] is consequent on a coincidence of natural factors unconnected with their life-histories. The present study on material of the two species from *Pennisetum typhoideum* [*P. typhoides*: 33, p. 420] and sorghum [34, p. 638], respectively, in Mysore, India, involved the analysis of these factors and attempts at their artificial reproduction in the laboratory.

Three conditions were shown to be important in sporangial development. In the first place, the lapse of 15 to 20 hours between two successive batches of sporangia is requisite for the organization of the primordia of the substomatal sporangiophores. Secondly, the atmosphere must be saturated with moisture to cause the condensation of a film or droplets of water on the leaf surface. Finally, sporangial formation is promoted by temperatures of 25° and 21° C. for the two species, respectively.

Under excessively humid conditions secondary branchlets develop on the sporangiophores of *S. graminicola*. This indeterminate type of growth has not hitherto been reported in the Peronosporaceae. At and below 15° sporangial production was considerably delayed, taking as long as 24 to 36 hours at 10°, at which temperature branching was completely suppressed, the sporangia being borne directly on sterigmata from the main axis.

Olson (E. O.) & Sleeth (B.). **Tristeza virus carried by some Meyer Lemon trees in south Texas.**—*Proc. R. Grande Vall. hort. Inst.*, 8, pp. 84–88, 1 fig., 1954.

Grafts from weak Meyer lemon trees on sour orange root stock on to West Indian lime in the Lower Rio Grande Valley showed that the scions carried the tristeza virus. Subsequent tests of the parent lemon tree showed this also to carry the virus. This is the first report of the tristeza virus in Texas [C.M.I. map No. 289], though it is probable that it has been present on some Meyer lemon trees for over 25 years. The apparent absence of spread to other citrus is encouraging.

Grimm (G. R.), Grant (T. J.), & Childs (J. F. L.). **A bud union abnormality of Rough Lemon rootstock with Sweet Orange scions.**—*Plant Dis. Reptr*, 39, 11, pp. 810–811, 1 fig., 1955. [Photo-offset.]

A bud-union abnormality possibly caused by a virus or virus complex is reported to be very common in Florida on rough lemon rootstocks with sweet orange scions, and particularly severe during the dry months of March to May. An orange-yellow discoloration of the inner bark at the bud-union is associated with rounded points and pegs extending into corresponding depressions in the wood. The orange-yellow to brown discoloration of the tissue underlying the cambium and outer layer of phloem indicates that much of the phloem is non-functional. The symptoms resemble those of cachexia disease [*R.A.M.*, 30, p. 226]. In one affected grove trees were trunk-grafted with Orlando tangelo and the sweet orange tops were cut off; striking symptoms of cachexia developed in the tangelo tops.

Roistacher (C. N.), Klotz (L. J.), & Eaks (I. L.). **Detecting surface injuries to fruit.**—*Calif. Citrogr.*, 41, 6, pp. 239–242, 2 figs., 1956.

Using 2,3,5-triphenyl tetrazolium chloride, a vital stain which changes from colourless to red in the presence of certain enzymes in living cells [cf. *R.A.M.*, 34, p. 788], the authors, working at the Citrus Experiment Station, University of California, were able to compare injuries (which become red after immersion of the fruit for 15 hours in a 0·2 or 0·5 per cent. solution of the stain) sustained by lemons under various methods of handling. Injury as estimated by this method was related to the subsequent level of *Penicillium* infection.

Bull (R. A.). **Bronze leaf wilt of Coconut palms in Nigeria.**—*J.W. Afr. Inst. Oil Palm Res., 1955*, 3, pp. 70–72, 2 pls., 1955.

The author describes the history and renewed occurrence of bronze leaf wilt of

coco-nut palms in the Awka area of Nigeria [cf. above, p. 589]. Its reappearance in 1951, after an interval of some 30 years or more, on the well drained soils of this area suggests a deficiency disorder rather than other unsuitable environmental conditions. It is thought that the comparatively rapid onset of the symptoms might be attributable to the collapse of the meristematic tissue in a plant with but one growing point, and that translocation of the deficient nutrient from old leaves to the bud might account for the progressive discoloration of the former. The appearance of the disease only in palms that have borne fruit for some years suggests that if it be due to a deficiency the element or elements concerned may be in greater demand after flowering and fruiting begins.

Pereau-Leroy (P.). **Recherches sur la fusariose du Palmier-Dattier.** [Researches on the fusariosis of the Date Palm.]—*Ann. Inst. Fruits et Agrumes colon., Paris, 1954*, 8, 27 pp., 37 figs., 1 map, 1954. [Photo-offset. Received August, 1955.]

In this comprehensive account of the results of his researches on 'bayoud' disease of date palms in North Africa, caused by *Fusarium oxysporum* var. *albedinis* [*R.A.M.*, 13, p. 505; 30, p. 154, *et passim*], the author states that he has observed cases in which the symptoms differ slightly from those described by Malençon. The attack at the base of the leaf is not always unilateral and may start midway in the dorsal part of the rachis, causing a brown vertical line. The leaflets only start to wither, basipetally, when the whole rachis has become necrotic.

Sometimes, two months before typical symptoms appear on a previously healthy tree, the first leaves to be affected may turn pale yellow and produce reddish-brown spots at the base of the rachis. Alternatively, affected leaves may turn a pale reddish-brown as they dry up, instead of bleaching. The Bou Rhar variety displays this symptom.

The withering of the rachis occurs only in the part exposed to the air; the base remains outwardly green (white in the heart-leaves), and the fungus is much less abundantly present here and in the stipe than in the aerial part of the leaf. Though the crown dies, the disease leaves few traces in the trunk beyond a few dark reddish-brown, more or less rectilinear lines 1 to 2 cm. wide, or a larger number of lines, each affecting only a few fibres. The longer the disease has been present, the more conspicuous is the discoloration.

Death of the tree follows the killing of the terminal bud by the fungus and is not due to the interruption of sap movement from the roots. Suckers from an affected tree may grow for ten years or more.

Infected trees may die in three weeks or survive for ten years, the average period between the appearance of the first symptoms and death being six months to two years. Instances of natural recovery are extremely rare and very dubious, and the disease must be regarded as invariably fatal. Infection takes place through the roots. The long incubation period (four or five years or more) makes the selection of resistant varieties a difficult task.

The disease appears to have started in the Drâa valley [10, p. 100] and to have spread eastwards and westwards, following the caravan routes. In Morocco infection has progressed gradually along the more or less continuous rows of palms. In Algeria, on the other hand, it is irregularly distributed. It would seem that the fungus is probably carried as mycelium within the host, extension of the area of infection being due to the transport of infected wood. The pack-saddles of the dromedaries in these regions are often made of dry date palm rachides, which are likely to be infected, and if pieces of these are thrown on the damp soil of a healthy plantation a new focus of infection subsequently appears.

The disease is unlikely to spread much farther west than Ifranc and Timoulay, since the plantings between Tarjicht and the sea (Fasq and Asrir) are not well

irrigated and do not provide the fungus with a suitable environment. Mauretania [see next abstract] lies 3,000 km. to the south, but this is not an insurmountable obstacle to spread by nomads. The plantation at Marrakeesh, the only one of importance in the area north of the Upper Atlas mountains, is not yet affected, though diseased trees are present only 200 km. away, at Ouarzazate. The greatest danger is in the east, where 60,000 to 80,000 trees in Tunisia, Libya, Egypt, and Irak may become exposed to infection. Losses vary greatly, and although in 20 years the fungus may destroy nine-tenths of a plantation, at present the average incidence of infection throughout the palm-growing areas of Morocco is 5 to 10 per cent.

The main factor conducing to an outbreak is heavy summer rain several years in succession, or the constant use of irrigation; infection is most rapid where there are associated cultures of lucerne and henna [*Lawsonia inermis*], combined with the presence of susceptible varieties. The disease is checked by drought. Extensive and rapidly developing outbreaks still occur in southern Morocco, where the trees are of the susceptible Bou Feggous variety and appear to be 60 to 80 years old. If the disease reaches Ouargla and Touggourt, and the Deglet Nour variety proves to be susceptible, the plantations at wadi Rhir, south of Constantine, where copious irrigation is practised (1 l. per sec. per ha.), are likely to suffer severely.

Varietal reaction ranges from extreme susceptibility to immunity. Susceptibility is strongly affected by cultural conditions, the Jihel date, for example, being almost unaffected at Ktaoua (south of the Drâa valley), where it receives very little water, but susceptible in areas where it is irrigated all the year round. Work on the selection of resistant varieties is in progress. The paper concludes with detailed descriptions of six highly resistant varieties, Bou Ijjou, Bou Stammi, Bou Zeggar, Iklane, Taadmamt, and Takerboucht, and a bibliography of 14 titles.

Munier (P.). **Le Palmier-Dattier en Mauritanie.** [The Date Palm in Mauretania.] —*Ann. Inst. Fruits et Agrumes colon., Paris, 1955*, 12, 66 pp., 6 figs., 8 maps, 1955. [Photo-offset.]

In the section of this publication dealing with the diseases of date palms in Mauretania (pp. 32–33) it is stated that *Fusarium* [*oxysporum* var.] *albedinis* [see preceding abstract] is present in every planting in southern Morocco and has spread to southern Algeria, but has not yet been observed in Mauretania. 'Heart-bend' (coeur qui penche) occurs sporadically in all parts of Mauretania, but appears to be most prevalent in Assaba and eastern Tagant; the heart leaves wilt and form a bundle which bends over in the shape of a question-mark. The first symptom is a change of colour by the middle leaves, which turn dark red; the leaflets then curl, dry up, and become whitish; the heart leaves in turn become affected, and the peripheral leaves wither and hang down the trunk, which becomes twisted and breaks. Affected trees invariably die. Necrosis is present in the terminal bud and the top of the trunk, but the base and roots are seldom affected. The disease is probably caused by a fungus.

Rot of the inflorescences, caused by *Mauginiella scaettae* [*R.A.M.*, 33, p. 228], occurs only locally, after heavy rain in spring. Rust (*Graphiola phoenicis*) [loc. cit.] is uncommon in eastern Tagant and Adrar, but widespread in southern Mauretania, where the rainfall is higher. Melanosis is very common throughout North Africa; in Mauretania it occurs only sporadically, in localities where the climate is characteristic of the Sahara desert, being present in eastern Tagant and Adrar, and very prevalent at Tidjikha. The skin of affected fruits hardens and thickens, and the fruits themselves become malformed, show brownish streaks, have a hard consistency, and sometimes burst along the streaks, exuding a white, viscous, very sweet liquid. The condition is associated with a number of fungi, including *Alternaria*, *Hormodendron*, *Penicillium*, *Phomopsis*, and *Rhizopus* [cf. 5, p. 82].

Bachy (A.). **Essai de divers produits anticryptogamiques contre la cercosporiose du Palmier à huile.** [A test of various fungicidal products against cercosporiosis of the Oil Palm.]—*Oléagineux*, 11, 4, pp. 231–233, 5 figs., 1956.

In a spraying test against *Cercospora elaeidis* [*R.A.M.*, 33, p. 350; cf. 35, p. 367] carried out at Sibiti, French Equatorial Africa, in 1953, young oil palms planted in a nursery in March, 1952, were treated with 3 per cent. dithane Z-78 spray (65 to 70 per cent. zineb) with addition of 0·06 per cent. triton; zineb dust at 10 per cent. of the preceding; zineb cuprosan spray at 0·5 per cent. with 0·1 per cent. etaldyne; 0·25 and 0·5 per cent. esso 406 (captan) spray; 0·5 per cent. nascent copper oxide (gignoux) spray; the same in oil (40 per cent. metallic copper and 25 per cent. oil) at 0·6 per cent.; 1 per cent. Bordeaux mixture; and copper carbonate dust (12·5 per cent. metal). Applications were made at fortnightly intervals from June (beginning of the dry season) until mid-October (beginning of the wet season). The value of the treatment was estimated at the end of the experiment according to a scale 0 = no infection to 10 = leaf completely dried up, on the three youngest leaves on each tree open at the time the first application was made.

It was found that there was least infection on the trees given the two dithane treatments, average infection indexes for the youngest leaf, the next, and the third youngest on five trees being 1·8 and 1·8, 6·4 and 4, and 9·4 and 6·6, respectively, as against 7·8, 9·2, and 9·8 for the untreated. All the materials used except the first two caused serious burning. It is recommended that only non-copper products should be used on oil palms. Suitable spray treatment should result in almost complete control of this disease, but as the intensity of infection varies greatly with the locality it will be necessary to find the best schedule for each area.

Meiffren (M.). **La rouille du Caféier en Côte d'Ivoire.** [Coffee rust in the Ivory Coast.]—*Bull. Cent. Rech. agron. Bingerville* 10, pp. 61–66, 1 col. pl. (facing p. 60), 1 fig., 1955.

Coffee rust (*Hemileia vastatrix*) was first reported from the Ivory Coast near Bocanda in September, 1953 [*R.A.M.*, 34, p. 773], and has since been found in the vicinity of Bondoukou, Abengourou, Adzope, Ouelle, M'Bahiakro, Dimbokro, Gagnoa, Oume, Divo, Lakota, Aboisso, Agboville, Sassandra, Tiassale, and Man. The varieties Indénié (*Coffea abeokutae*), Kouillou (*C. canephora* var. *typica*), and [C.] *robusta* INEAC are attacked.

Recommended control measures include burning diseased leaves, judicious pruning, manuring, and spraying the trees from the foot upwards in dry weather with 1 per cent. Bordeaux mixture plus casein, 0·8 per cent. cuprous oxide, or 1·5 per cent. copper oxychloride. It is pointed out, however, that spraying is quite useless unless the above sanitation methods are applied, and to be fully effective it must take place before the fungus penetrates the leaf tissues.

Naryanan (B. T.). **Sixth and seventh Annual Reports of the Research Department of the Indian Coffee Board (1952–53, 1953–54).**—*Bull. Indian Coff. Bd Res. Dep.* 6, 91 pp., 1954; 7, 91 pp., 1955. R.1.

In the first of these reports [cf. *R.A.M.*, 34, p. 595] it is stated (pp. 64–67) that in continued spraying experiments against leaf disease [*Hemileia vastatrix*] of coffee Bordeaux mixture 2–2–40 with stanvac detergent (6 oz. to 40 gals.) gave the highest yield of ripe cherry per acre (369 lb.): with caltex corvus oil (7½ oz.) 334 lb. were obtained. The proprietary copper fungicides were in general less successful. In another trial, however, blitox (1 lb. to 40 gals.) resulted in a yield of 1,459 lb. as opposed to 924 lb. with Bordeaux mixture. In experiments with wetters and spreaders (pp. 73–76) the addition of ¾ oz. of teepol-X to [? 40 gals.] Bordeaux mixture was as effective as 1½ oz.

In the second report mycology is dealt with on pp. 74–80. Wilting coffee trees

with brown to black lines in the roots and sometimes brown or grey discoloration yielded a species of *Fusarium* [cf. 31, p. 15]. *Aspergillus tamarii* [31, p. 115] was isolated from a dead borer beetle [? *Xylotrechus quadripes*] and experiments indicated that the fungus may be parasitic on these insects.

Lagière (R.). **Conservation et traitement des semences du Cotonnier.** [The preservation and treatment of Cotton seed.]—61 pp., 5 graphs, Paris, Institut de Recherches du Coton et des Textiles Exotiques, 1954.

The information presented in this publication on the preservation and fungicidal treatment of cotton seed has already been noticed from other sources [*R.A.M.*, 33, pp. 537, 673].

Kalyanasundaram (R.) & Venkata Ram (C. S.). **Production and systemic translocation of fusaric acid in Fusarium-infected Cotton plants.**—*J. Indian bot. Soc.*, 35, 1, pp. 7–10, 1 pl., 1956.

At the University Botany Laboratory, Madras, fusaric [? fusarinic] acid was extracted from cotton plants infected with *Fusarium vasinfectum*, and assayed in comparison with the pure acid by a modified agar cup technique [*R.A.M.*, 35, p. 386]. Its distribution within the plants was studied by observing the extent of inhibition of [unspecified] bacterial growth round crushed sections from various parts of infected plants, when these were placed on agar plates seeded with the bacteria. There was no inhibition round comparable sections from healthy plants.

Under the conditions of the experiment plants two to three weeks old contained an average of 17·28 μgm. of the acid.

Radha (K.). **Soil conditions and root diseases. XVI. Colonization and survival of Macrophomina phaseoli (Maubl.) Ashby in trace element amended soils.**—*J. Indian bot. Soc.*, 35, 1, pp. 47–52, 1956.

Using black soil from land affected by cotton root rot (*Macrophomina phaseoli*) [*R.A.M.*, 35, p. 524] the author studied at the University Botany Laboratory, Madras [cf. 35, p. 386], the effects of adding zinc, manganese, and boron on (1) the survival of the fungus in buried pieces of experimentally infected cotton stubble; (2) the ability of the fungus to colonize buried fragments of dead host tissue; and (3) the composition of the general soil microflora.

The survival in infected stubble was unaffected, the fungus being recovered from all pieces after 24 to 42 weeks. The colonization of dead host tissue was inhibited by boron and zinc. All three elements promoted an increase in the general soil microflora (fungi, bacteria, and actinomycetes) determined by the dilution method. The author postulates that colonization is inhibited indirectly by the increase of microbial antagonism, and that survival in stubble is unaffected because it depends on the presence of resistant sclerotia.

Marsh (P. B.), Bollenbacher (K[atherina]), San Antonio (J. P.), & Merola (G. V.). **Observations on certain fluorescent spots in raw Cotton associated with the growth of microorganisms.**—*Text. Res. J.*, 25, 12, pp. 1007–1016, 1 fig., 1 graph, 1955.

At the Field Crops Research Branch, United States Department of Agriculture, Beltsville, Maryland, a remarkable and characteristic type of spot, fluorescing greenish-yellow under ultra-violet light, was frequently observed in samples from the 1954 cotton crop grown round Yuma, Arizona, and Brownsville, Texas, and less commonly in material from other regions of the latter State and elsewhere. The defect is attributed to the growth on the fibre of *Aspergillus flavus*, three main lines of evidence having been secured in support of this hypothesis: (1) the preva-

lence of the mould in the fluorescent spots; (2) the production of a similar fluorescence by the same species growing on cotton fibre in pure culture; and (3) the similarity of the fluorescent substances from field fibre and that incubated with *A. flavus* in chromotographic behaviour and absorption spectrum. The fluorescent fibre in commercial samples swelled to an abnormal extent in alkali and its strength was reduced.

A relatively inconspicuous white-fluorescent spot was found to be associated with certain isolates of *Alternaria* sp. [*R.A.M.*, 33, p. 547]. Several other common forms of mould growth developing on cotton before harvesting were not accompanied by distinct differences in fluorescence as compared with uninfected fibre, indicating that ultra-violet examination, as employed in these studies, is not a universal tool for the detection of all kinds of microbial invasion of commercial samples.

DAHLSTROM (R. V.). **Biochemical studies on the Golden Nematode (Heterodera rostochiensis Wollenweber) hatching factor.**—*Diss. Abstr.*, 16, 1, pp. 17–19, 1956.

Overwintered cysts of the potato eelworm (*Heterodera rostochiensis*) are stimulated to hatch by secretions of the actively growing potato or tomato roots on which they live. At Cornell University [Ithaca, New York], the isolation of microorganisms from the soil surrounding actively growing tomato plants revealed that *Aspergillus awamori* responded to added concentrates of the hatching factor as measured by the increase in mat weight and acid production on a medium containing glucose, salts, yeast, peptone, and sodium acetate. It is to be used for assays of this factor.

SCHAERFFENBERG (B.). **Die Hauptfruchtform (Ascus-Form) von Beauveria bassiana (Vuill.) Link und B. densa (Vuill.) Link.** [The perfect state (ascus state) of *Beauveria bassiana* (Vuill.) Link and *B. densa* (Vuill.) Link.]—*Z. PflKrankh.*, 62, 8–9, pp. 544–549, 11 figs., 1955.

The results of prolonged studies at Graz, Austria, on the life-histories of *Beauveria bassiana* [cf. *R.A.M.*, 32, p. 557] and *B. densa* [cf. 25, pp. 113, 449] have yielded convincing evidence that these fungi are in no way related to *Cordyceps* or other entomogenous fungi. The yellow, later blackish-brown, urceolate to ampulliform perithecia of both species, measuring 0·04 to 0·25 by 0·03 to 0·3 mm., develop on the free, undifferentiated mycelium below the conidial stratum and not on specialized clavate structures. In *B. bassiana* most of the perithecia are small, whereas in *B. densa* larger ones tend to predominate. The cylindrical ascospores are released from the flask-shaped asci in bundles, and break up into spores 2 to 3 by 1 to 1·25 μ. On germination they give rise to a mycelium bearing conidiophores and chains of conidia in coremia. Under optimum conditions, in five to six weeks, the surface of the agar medium is strewn with mushroom-shaped or clavate bodies; the coremia formed on insect mummies also originate from the germinating ascospores.

Deposited on a new host, the ascospores produce germ-tubes which penetrate the chitin layer into the body cavity, where they branch out into a mycelium with small, pale, cylindrical conidia which invade the blood and multiply enormously by continuous budding; this process eventually leads to mummification of the dead insect. Characteristic of the life-cycles of both *B.* spp. is the regularly alternating appearance of the ascospores and the conidia abstricted from their germ-tubes in the blood of the host.

The implications of these findings in relation to Gäumann's reclassification of the Ascomycetes [29, p. 110] are briefly discussed.

Knowles (P. F.), Houston (B. R.), & McOnie (J. B.). **Inheritance of resistance to Fusarium wilt of Flax in Punjab 53.**—*Agron. J.*, 48, 3, pp. 135–137, 1 graph, 1956.

Soil inoculation experiments at the University of California, Davis, demonstrated that the flax variety Punjab 53, a composite of selections resistant to wilt (*Fusarium oxysporum* f. *lini*) derived from a single resistant plant of Punjab 165, owes its resistance to the fungus clones 287 and 294 to the complementary genes Fu_A or A and Fu_B or B; the original plant apparently possessed the genotype AaBB or AABb. A third gene C found in Dakota 48–94 [*R.A.M.*, 35, p. 16] would account for much of its resistance to clone 33–1, which was highly pathogenic to Punjab 53.

Ignatovich (G.). Химический метод борьбы с полиспорозом Льна. [A chemical method of controlling polysporosis of Flax.]—Земледелие [*Zemledelie, Moscow*], 4, 1, pp. 93–96, 1956.

From 1951 to 1954, inclusive, a number of chemicals were tested in plot experiments at the Department of Plant Protection, Pskov Regional Flax Experiment Station, U.S.S.R., for the control of *Polyspora lini* on flax [*R.A.M.*, 18, p. 256], which is serious and occurs almost every year in the area. All the treatments (at 1 per cent. concentration sprayed at ten-day intervals during budding and flowering) reduced infection and increased yields in comparison with water-treated controls. Cupric chloride (20 kg. per ha.) was, however, the most effective and reduced stem infection by three times in 1951, seven in 1952, six in 1953, and five in 1954. Thiram was also very effective but needs further testing.

In laboratory experiments in 1954 spores of *P. lini* and *Fusarium lini* in pure culture on agar and Czapek's medium were killed in considerable numbers by 3 to 5 per cent. concentrations of the chemicals with a further increase by an 8 per cent. concentration.

In small-scale field plot trials, carried out to check these findings, infection by *P. lini* was practically eliminated when spraying was done in the first half of July during flowering with 3 to 5 per cent. cupric chloride or 5 per cent. thiram (both at 700 to 800 l. per ha.). The infection percentage was increased considerably (up to 9·2 per cent.) when the concentration was raised to 8 per cent. However, when the cupric chloride was combined with potassium chloride and increased from 3 to 5 per cent. infection was reduced from 11·1 (water-treated control) to 0 per cent. Similarly, anthracnose [*Colletotrichum linicola*: loc. cit.] was reduced from 86·2 (control) to 25·4 per cent. The increased concentrations of the chemical had no adverse effect on yield or quality.

Wieringa (K. T.). **The micro-organisms decomposing pectic substances in the dew retting process of Flax.**—*Netherlands J. agric. Sci.*, 4, 2, pp. 204–209, 1 graph, 1956.

In studies at the Agricultural University, Wageningen, Holland, flax was laid out in a field to be retted by dew [cf. *R.A.M.*, 21, p. 370] every month from September, 1952, until August, 1953. Isolations were made at the conclusion of each retting period by means of a special technique employing pectin agar plates. From the data obtained the author concludes that in Holland *Cladosporium herbarum* [cf. 26, p. 452] is the most important retting organism in summer, while *Cryptococcus albidus*, *Rhodotorula glutinis*, and *R. macerans* n.sp. [without a Latin diagnosis] are responsible for most of the retting in winter. *Pullularia pullulans* [21, p. 370] may be of some importance in spring and autumn, while some bacteria, such as *Pseudomonas fluorescens* [cf. 31, p. 9; 33, p. 284], may be important throughout the year. As *Cladosporium herbarum* and certain other fungi impart an unsuitable colour to the fibre and also attack cellulose, dew-retting should be done in winter.

Reinking (O. A.). **Review of Abaca mosaic control program in the Philippines, 1950–1954.**—Agriculture Division, United States of America Operations Mission to the Philippines, Manila, 34 pp., 1955. [Mimeographed.]

This report reviews the measures taken between 1950 and 1954 to control abaca mosaic virus [? strain of cucumber mosaic virus] in the Philippines [*R.A.M.*, 32, p. 481; 35, p. 453]. Where maize is used for interplanting abaca [*Musa textilis*] plantings have a life of only 4 to 18 months, and where it adjoins them, their probable life is 2½ to 6 years. Complete absence of maize from abaca areas, and assured total destruction of diseased plants with 2,4-D (not economically practical where there is over 16 per cent. infection) is essential to control the disease. Further research is necessary into the nature and behaviour of vectors and the identity of other hosts (the virus of *Panicum colonum*, for instance, may be that of abaca). Vector control by spraying needs further investigation. Breeding of resistant varieties is in progress. With proper control, healthy new plantations with under 3 per cent. disease can be established, but difficulties are being experienced in obtaining clean nursery material and establishing healthy plantings in certain areas, the reasons for which are not yet fully understood.

Timonin (M. I.) & Self (R. L.). **Cylindrocladium scoparium Morgan on Azaleas and other ornamentals.**—*Plant Dis. Reptr*, 39, 11, pp. 860–863, 2 figs., 1955. [Photo-offset.]

Indica azalea (*Rhododendron indicum*), Kurume azalea (*R. obtusum* [var.] *japonicum*), *Magnolia soulangeana*, *Hydrangea* sp., *Ilex rotundifolia*, *Pyracantha* sp., bottle-brush (*Callistemon rigidus*), and *Poinsettia* are reported from Alabama to be new hosts of *Cylindrocladium scoparium* [cf. *R.A.M.*, 30, p. 345; 33, p. 512; 34, p. 138]. Blight and wilt were characteristic of naturally infected and inoculated azaleas and of inoculated cuttings of *Pyracantha* and *I. rotundifolia*. The leaf spots on *Pyracantha* were zonate. On spray-inoculated magnolias a black, soft rot rapidly spread over the leaves and succulent stem tips; when the rooting medium was inoculated the decay invaded the bark and, in the case of very succulent cuttings, even the wood. A brownish vascular discoloration affected the older wood.

Attention is drawn to the similarity of the disease symptoms and morphological characteristics of *C. scoparium* to those of *Rhizoctonia* sp., which may often have been named incorrectly as the agent of the *Cylindrocladium* disease. For reliable identification, isolations should be made on both potato-dextrose agar and modified yeast extract-mannitol agar, the latter inducing the formation of typical *Cylindrocladium* conidiophores and conidia.

Clum (F. M.). **A new genus in the Aspergillaceae.**—*Mycologia*, 47, 6, pp. 899–901, 1955.

A fungus isolated in the United States from a *Phlox drummondii* seedling with symptoms of damping-off is tentatively placed in the Aspergillaceae and assigned to a new genus, *Pycnidiophora*, as *P. dispersa* n.sp. It is characterized by an astomous, brown-walled cleistocarp with globose asci scattered irregularly throughout the cavity, and differs from all the other members of the Aspergillaceae in having a pycnidial state. The asci are 10 to 14·5 μ in diameter and the hyaline, later light brown ascospores 2 to 2·9 by 2·8 to 5·8 μ. The globose to irregular-elongate, glabrous pycnidia measure 26 to 78 by 26 to 164 μ, with hyaline, one-celled, oblong conidia 1·5 to 3·4 by 2·6 to 4·75 μ. Pathogenicity was established experimentally on aster, phlox, and Regal lily.

Brierley (P.). **Blazing Gold as a test variety for the Chrysanthemum flower-distortion virus.**—*Plant Dis. Reptr*, 39, 12, pp. 899–901, 2 figs., 1955. [Photo-offset.]

Studies at Beltsville, Maryland, suggest that because of some of its symptoms

and its failure to be transmitted by sap inoculation, the chrysanthemum flower distortion virus [*R.A.M.*, 34, p. 456] is related to the aster yellows group [cf. 35, p. 299]. Its introduction from Europe is believed to have been quite recent, but since it occurs in American rather than imported varieties a vector must be present in the United States. Attention is drawn to the potential importance of the disease should an efficient vector exist. The variety Blazing Gold develops rosetting of the shoot tips two months after graft inoculation and is considered to be the best test variety known.

Fischer (R.). **Über das Auftreten von Virussymptomen an Holzgewächsen nach dem Rückschnitt.** [On the appearance of virus symptoms in woody plants following cutting back.]—*PflSchBer.*, 15, 5–6, pp. 65–77, 5 figs., 1955. [English summary.]

The author reports the occurrence, for the first time in Austria, of the virus-like diseases ring spot of lilac [cf. *R.A.M.*, 35, p. 190] and ring spot mosaic of elder (*Sambucus nigra*). Both occurred on previously symptomless bushes which had been heavily pruned. Other examples are cited from the literature of virus symptoms appearing in lush foliage growing after heavy pruning. Possible explanations of the phenomenon are discussed.

Hemmi (T.) & Kawase (Y.). **On a new anthracnose of Water-lily caused by Gloeosporium nymphaeae sp. n.**—*Bull. Naniwa Univ.*, Ser. B, 4, pp. 1–6, 1 fig., 1954.

During the summers of 1953 and 1954 a destructive leaf spot disease was observed on water lilies (*Nymphaea* sp.) in the garden of the College of Agriculture, Naniwa University, Japan. Brown or light greyish-brown, circular, semicircular or elliptical spots, 2 to 27 by 2 to 17 mm., on the upper surfaces were caused by an undescribed species of *Gloeosporium*, designated *G. nymphaeae* n.sp. The acervuli are 120 to 165 μ in diameter, with conidia 15 to 46 by 5 to 7 μ. Pathogenicity was proved by inoculation.

Hino (I.) & Katumoto (K.). **Illustrationes fungorum bambusicolorum II.** [Illustrations of Bamboo-inhabiting fungi II.]—*Bull. Fac. Agric. Yamaguti Univ.* 5, pp. 213–234, 22 figs., 1955.

In this further contribution [cf. *R.A.M.*, 18, p. 204 and see above, p. 561] 21 fungi found on bamboo in Japan are described and illustrated, including 13 new species.

Smith (J. D.). **Ophiobolus patch disease.**—*Parks*, 21, 7, pp. 431–432, 1 fig., 1956.

Much of the information in this article has already been noted from another source [*R.A.M.*, 32, p. 435]. When severe outbreaks of *Ophiobolus graminis* var. *avenae* occur on turf in Great Britain they often result from liming, and where the lime has been unevenly applied a correlation may be observed between the level of liming and the severity of the disease. Where the disease follows liming it takes from one to three years for the onset of severe symptoms, and these begin to decline three to four years from the date of liming. The disease has been noted, though in a mild form, where no lime or fertilizer has been applied for ten years.

Sprague (R.). **Some leafspot fungi on western Gramineae. IX.**—*Mycologia*, 47, 6, pp. 835–845, 1 fig., 1955.

In this contribution to the present series [cf. *R.A.M.*, 35, p. 102] descriptions are given of new and noteworthy fungi collected chiefly in north central Washington, Idaho, and the Rocky Mountains. It includes *Hyalothyridium sorghicola* n.sp. associated with *Helminthosporium turcicum*, *Phyllosticta sorghina*, and various [unspecified] moulds on sorghum, *Ascochyta sorghi*, associated with *Hendersonia sorghi* on *Festuca elatior*, *Phleospora muhlenbergiae* on *Muhlenbergia filiformis*, *Septoria oudemansii* on *Setaria viridis*, *A. utahensis* on *Elymus triticoides*, *Septoria*

infuscans on *Agropyron inerme*, *Stagonospora intermixta* on *Agrostis palustris*, *Ovularia pusilla* (Ung.) Sacc. & D. Sacc. emend. on a number of Gramineae, including *Bromus inermis* which was heavily infected in one field, *Curvularia geniculata* on dead leaves of living plants of *Digitaria ischaemum*, *Rhynchosporium secalis* on *Agropyron intermedium* and *A. repens*, *Fusarium nivale* [*Calonectria nivalis*] on *A. cristatum* and *Festuca idahoensis*, *Erysiphe graminis* on *Poa compressa*, *Septoria nodorum* (uniseptate phase) on *Melica smithii* and (microspores) on *M. subulata*, *Colletotrichum graminicola* on *M. subulata* and, in association with *Puccinia coronata*, on *Agrostis alba*, *Selenophoma donacis* on *Agropyron subsecundum* var. *andinum*, *Scoletotrichum graminis* on *Agrostis scabra*, *A. exarata* var. *monolepis*, and *Bromus breviaristatus*, and *Septoria tenella* on *F. idahoensis*.

Sill (W. H.) & Pickett (R. C.). **Brome mosaic—a threatening grass virus disease.** —*Plant Dis. Reptr*, 39, 11, p. 802, 1955. [Photo-offset.]

A severe outbreak of brome mosaic virus [*R.A.M.*, 32, p. 674] affected many clones of smooth brome grass (*Bromus inermis*) in the grass breeding nursery at Kansas State College in 1955. In a small three-year-old nursery 116 out of 650 plants were infected. The relatively wide distribution of the virus in Kansas and the severity of the disease on several other small grains and grasses after artificial inoculation indicate its potential importance. Every effort should be made to check its spread and eliminate it from breeding nurseries.

Kohlmeyer (J.). **Beobachtungen über die Lebensweise von Epichloë typhina (Pers.) Tul.** [Observations on the habit of *Epichloe typhina* (Pers.) Tul.]—*Ber. dtsch. bot. Ges.*, 69, 3, pp. 149–157, 2 pl., 1956.

In an ecological survey of *Epichloe typhina* [*R.A.M.*, 33, p. 726] in the districts of Berlin and Hamburg in 1955 the fungus was found on a number of grasses, predominantly in semi-shaded situations, and was quite widespread in spite of the hot summer. Some stromata were found in an unusual position, affecting the stalks at the level of the inflorescences, and there were transitional stages between this and the normal location round the leaf sheaths. When the stroma was at the usual site the grass occasionally sent out a sprout from the node immediately below. Some hyperparasitic fungi were noted, including a species of *Trichothecium* (*T.* ? *roseum*).

Korobeinikova (Mme A. V.). Влияние удобрений на повышение урожайности Клевера и снижение фузариозных заболеваний. [The effect of fertilizers on the increase in Clover yields and the decrease in *Fusarium* infections.]—Земледелие [*Zemledelie, Moscow*], 4, 1, pp. 108–110, 1956.

Plot experiments carried out in 1952 and 1953 in the Sverdlov region of the U.S.S.R. showed that adding granulated superphosphate (45 kg. per ha.) or superphosphate powder (15 kg.) to the soil five to seven days before sowing clover seeds previously treated, as well as those of the spring wheat cover crop, with granosan (1·5 kg. per ton of seed) reduced infection of the clover by *Fusarium* spp. [*R.A.M.*, 35, p. 460] in 1952 from 36 (without fertilizer) to 10 and 2 per cent., respectively, and in 1953 from 38·7 to 16·6 and 7·8 per cent., respectively. On a plot treated with phosphate powder mixed with humus none of the plants died during the winter, while with the granulated there was 30·4 per cent. less death than on the unfertilized. In the second year of growth infection of clover plants on fertilized soil was significantly lower (11·8 per cent. for granulated superphosphate and 23·7 for powder) than on control plots. Spring application of fertilizers was found to cause growth of new roots thus preventing death of the plants and increasing yields.

In a commercial experiment in 1952 ammonium nitrate, potassium salt, and superphosphate, all at 60 kg., were applied to the soil surface in early spring

separately and in combination. All reduced infection and increased yields, the complete fertilizer giving the best results, reducing *Fusarium* infection from 63·7 (control) to 16 per cent. and giving seed and straw yields in comparison with the control (taken as 100) of 291·7 and 217·3, respectively.

To maintain the quality of the sward and reduce *Fusarium* infection in the spring of the third year of clover growth fertilizers were applied at harrowing immediately following hay harvest. Infection percentages were lowest (40) with phosphorus plus potassium and highest (58·3) with the combined, as against 60·8 for the unfertilized.

Nüesch (B.). **Der Kleekrebs (Sclerotinia trifoliorum Eriksson).** [Clover rot (*Sclerotinia trifoliorum* Eriksson).]—*Mitt. schweiz. Landw.*, 4, 2, pp. 17–21, 3 figs., 1956.

Well-known information on the symptoms, life-history, and control of clover rot (*Sclerotinia sclerotiorum*) in Switzerland [*R.A.M.*, 27, p. 479] is summarized very briefly in semi-popular terms. In 1954 and 1955 active foci of infection could still be detected at the time of the first cut (end of May) in the central regions of the country. In two preliminary inoculation experiments, each on 100 three-month-old plants, the numbers of red, Alexandrian, and crimson clovers surviving at the end of three weeks were 18 and 22, eight and 11, and two and 0, respectively. Lucerne was not used in the first test but there were 43 survivors in the second.

Gerdemann (J. W.). **Occurrence of Polymyxa graminis in Red Clover roots.**—*Plant Dis. Reptr*, 39, 11, p. 859, 1 fig., 1955. [Photo-offset.]

Polymyxa graminis [*R.A.M.*, 34, p. 291] was found in 1955 in red clover roots collected from a field on the Agronomy South Farm at Urbana, Illinois. The abundance of spore clusters indicated that the fungus may cause injury to the roots under certain conditions.

Harris (R. V.). **Virus diseases and the fruit farmer.**—*J.R. agric. Soc.*, 115, pp. 83–97, 4 pl., 1954.

The author surveys the present information on the virus diseases of a number of fruit crops in Great Britain (with 44 references). He considers that control will be achieved only when growers collectively decide to obtain their planting stocks from guaranteed sources, covered by appropriate schemes of health certification [*R.A.M.*, 34, p. 39].

1955 spray recommendations for tree fruits in eastern Washington.—*Ext. Bull. St. Coll. Wash.* 419 (revised), 31 pp., 9 figs., 1955.

On pp. 10–15 of this bulletin details are given of the symptoms and control of the most important diseases of apples and pears in eastern Washington with a tabulated spray programme; nutritional sprays to correct mineral deficiencies are described on pp. 17–18; and the control of the principal diseases of stone fruit on pp. 24–28.

Armillaria root rot of fruit trees.—*Agric. Gaz. N.S.W.*, 67, 2, pp. 94–97, 5 figs., 1956.

This is a general note on the root rot of fruit trees in New South Wales caused by *Armillaria mellea* [*R.A.M.*, 32, p. 175] and its control, along conventional lines. Treatment is recommended for healthy trees exposed to infection.

Bollard (E. G.). **Boron and manganese trace element deficiencies in fruit crops in New Zealand.**—*Orchard. N.Z.*, 29, 1, pp. 16–17, 19, 21, 10 figs., 1956.

Much of this information on boron and manganese deficiencies in fruit crops in New Zealand has already been noticed from other sources [*R.A.M.*, 19, p. 30; 32,

pp. 398, 571; 33, p. 33; 35, p. 109]. Additional notifications are: boron deficiency in cherry [loc. cit.], plum [loc. cit.], and pear [cf. 33, p. 433] in Central Otago and manganese deficiency in citrus in Auckland [cf. 26, p. 555], cherry in Central Otago [cf. 32, p. 632], passion fruit in Auckland [33, p. 363], and raspberry in Invercargill. Applying $\frac{1}{4}$ to $\frac{1}{2}$ lb. borax to the soil in the spring every alternate year or annually in severe cases effectively controls the former [cf. 26, p. 158; 31, p. 70]. Careful consideration should be given before applying lime in orchards deficient in either boron or manganese.

Bollard (E. G.). **Zinc deficiency of fruit crops in N.Z.**—*Orchard. N.Z.*, 29, 2, pp. 3–4, 3 figs., 1956.

Most of this information on zinc deficiency of fruit in New Zealand has already been noticed from other sources [*R.A.M.*, 33, pp. 34, 37; 34, p. 215]. Apricots [cf. 34, p. 230] are reported to be affected in many parts of the Central Otago fruit-growing area. This deficiency was also serious in some sweet orange [32, p. 311] orchards in the Kerikeri district. Dormant spraying of deciduous trees with 5 per cent. zinc sulphate (50 lb. in 100 gals.) in badly affected orchards, or 2·5 per cent. in less severe cases is recommended. A 1 per cent. spray annually or at 2·5 per cent. in alternate years is used for trees with a slight deficiency or for those that have been sprayed heavily for two or three years.

Stojanović (D.) & Kostić (B.). **Dejstvo kreozana na razvoj peritecija Venturia inaequalis.** [The effect of creosan on the development of perithecia of *Venturia inaequalis*.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 32, pp. 49–53, 1955. [English summary.]

At the Institute for Plant Protection, Kragujevac, Yugoslavia, the application of creosan (based on DNC) caused deformation of the perithecia of the apple scab fungus, *Venturia inaequalis* [*R.A.M.*, 35, p. 375], and prevented ascospore development. The concentration of the chemical and number of applications were unimportant, but timing was a decisive factor, treatment of the leaves being most effective before the formation of asci, i.e., in the autumn soon after leaf-fall.

Boone (D. M.), Stauffer (J. F.), Stahmann (M. A.), & Keitt (G. W.). **Venturia inaequalis (Cke.) Wint. VII. Induction of mutants for studies on genetics, nutrition, and pathogenicity.**

Boone (D. M.) & Keitt (G. W.). **Venturia inaequalis (Cke.) Wint. VIII. Inheritance of colour mutant characters.**—*Amer. J. Bot.*, 43, 3, pp. 199–204, 1 fig.; pp. 226–233, 1 diag., 1956.

In further studies in this series conducted in the Departments of Plant Pathology, Botany, and Biochemistry, University of Wisconsin, Madison [cf. *R.A.M.*, 33, p. 487; 35, p. 195], morphological, colour, and biochemical mutants were obtained from two monoascosporic wild-type lines of *Venturia inaequalis* [34, p. 231] by treatment with nitrogen mustard and ultra-violet light.

Twelve induced colour mutants of the fungus are described in the second paper with details of the inheritance of their mutant characters. Three of the genes conditioned abnormal ascospore development.

Sprague (R.). **Compatibility of sodium pentaborate with Apple powdery mildew sprays.**—*Plant Dis. Reptr*, 39, 11, pp. 820–821, 1955. [Photo-offset.]

In one season's trials at the State College of Washington, Tree Fruit Experiment Station, Wenatchee, polybor (sodium pentaborate, used to correct boron deficiency on apple trees) was added at the rate of $\frac{1}{2}$ lb. per 100 gals. to the pre-pink sprays of liquid lime-sulphur, karathane, polysulphide compound, and orthorix, without appreciably decreasing their efficiency against mildew (*Podosphaera leucotricha*) [*R.A.M.*, 34, p. 736; 35, p. 378].

Michiels (A.), Questienne (H.), & Semal (J.). **Étude comparative de quelques fongicides contre la moniliose.** [A comparative study of some fungicides against moniliasis.]—*Parasitica*, 10, 4, pp. 100–109, 1954.

At the La Roncière Centre for Fruit Research, La Hulpe, Belgium, detached Cox's Orange Pippin apples wounded with a needle in four places were sprayed (on a revolving plate) with various fungicides, inoculated with a conidial suspension of *Sclerotinia fructigena* [cf. *R.A.M.*, 33, pp. 90, 436], and then placed in optimum conditions for infection. Fungal development was reduced by 0·4 per cent. 2-heptadecylglyoxalidine (0·136 per cent. active material), 0·4 per cent. captan (0·2), 0·3, 0·4, and 0·5 per cent. thiram (0·24 to 0·4), and 4 and 5 per cent. copper oxychloride (0·2 and 0·25). Captan and thiram were significantly more fungicidal than the other products tested (including lime-sulphur). In three of five replications captan gave complete protection.

Posnette (A. F.) & Cropley (R.). **Apple mosaic viruses. Host reactions and strain interference.**—*J. hort. Sci.* 31, 2, pp. 119–133, 2 pl., 4 graphs, 1956.

Eighteen apple rootstock clones and twelve scion varieties were examined at East Malling Research Station for their sensitivity to one or more of three strains of apple mosaic virus [*R.A.M.*, 33, p. 88], virulent, intermediate and mild. The results are given in tabular form. Symptoms of the virulent strain varied from very intense on Lord Lambourne and Allington Pippin to slight on Lane's Prince Albert, while of the root stocks tested M. IX and M. XXV were the most and M. II and M. XVI the least sensitive, several clones showing no symptoms with the mild strain.

The virulent strain depressed the yield of sensitive varieties, even that of mature trees. The reduction of crop in the fourth year amounted to 40 per cent. in Cox's Orange Pippin and 30 per cent. in Allington Pippin, though Worcester Pearmain and Newton Wonder showed little effect. Much greater losses can be expected in Bramley's Seedling propagated from infected scion wood. The evidence for crop loss caused by the mild strain is inconclusive except for Cox's.

There is no evidence of spread from tree to tree, other than by occasional natural root grafting, and spread must usually be due to propagation with diseased material. As the virus is non-systemic in vigorous shoots, healthy buds may be taken from their tips. Also young plants kept at 37° C. for 27 days may be freed from infection, either completely, or sufficiently to yield healthy buds; heat treatment of scion wood is not practicable.

Despite failure to become fully systemic in the host, mild strains conferred protection against subsequent inoculation with virulent strains, suggesting that the latter remain localized near the point of inoculation.

Three apparently new strains of the virus are described, a vein-clearing type, a line pattern type producing wavy patterns on the leaves, and a ring spot type. M. II is the only rootstock clone known to show symptoms of the vein-clearing strain. The line pattern, first seen on Laxton's Superb, has been transmitted to a number of rootstocks. The ring spot strain is seen on the first leaves of Lord Lambourne on M. XII stocks and the evidence suggests that a high percentage of these are infected.

Non-transmissible mosaic-like and chimaera-like variegations encountered are described.

Ark (P. A.). **Use of streptomycin-pyrophyllite dusts against Pear blight and Walnut blight.**—*Plant Dis. Reptr*, 39, 12, pp. 926–928, 1955. [Photo-offset.]

Laboratory assays in 1954 failed to demonstrate any free streptomycin in a dust formulation with bentonite [*R.A.M.*, 33, p. 94] which had given variable results against fireblight of pear (*Erwinia amylovora*). In 1955 at the Department of

Plant Pathology, University of California, Berkeley, the pyrophyllites [cf. 34, p. 405], ABB (pH 4·6) and Nuclay (pH 8·1) were blended with streptomycin base at 500 and 1000 p.p.m. for the control of fire blight of pear and walnut (*Xanthomonas juglandis*) [32, p. 704]. Biossay of the numerous samples of dusted pear blossoms revealed a considerable quantity of available streptomycin. The dusts compared favourably with wettable streptomycin (agri-strep and phytomycin) and with copper-lime dust in controlling *E. amylovora* and were more economical than the wettable formulations. Against *X. juglandis* they were better than copper dust but not as good as the wettable formulations, possibly because of unsatisfactory adherence.

Jovićević (B.). **Pepelnica na Kruški.** [Powdery mildew on Pear.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 30, pp. 37–39, 1 pl. (between pp. 48–49), 1955. [English summary.]

A description is given of *Phyllactinia suffulta* (which the author considers synonymous with *P. corylea*) and its occurrence in 1953 and 1954 on pear trees at the Institute for Agricultural Researches at Peć, Yugoslavia [cf. *R.A.M.*, 31, p. 594].

Goodman (R. N.). **Late season twig-infection, a serious limitation to the effectiveness of antibiotic sprays for fireblight control.**—*Plant Dis. Reptr*, 39, 12, pp. 922–925, 1 diag., 1955. [Photo-offset.]

In plot experiments on the control of apple fireblight (*Erwinia amylovora*) [*R.A.M.*, 34, p. 529; 35, p. 25] in two orchards at Lexington and Savannah, Missouri, Jonathan trees were sprayed with 25 and 50 p.p.m. agrimycin, alone and in combination with captan-zineb (Lexington) and sulphur paste (Savannah) at intervals of five days for the first three sprays and seven for the subsequent three, insecticides being added to some of the sprays. With all treatments, considerable twig blight was noticed in both orchards two to three weeks after full bloom and before the end of the spray schedule. At Lexington the outbreak soon reached epiphytotic proportions. This infection was correlated in most cases with the reactivation of holdover cankers, many of which were oozing freely. It is suggested that fireblight in a given season may occur in two distinct waves, each being a primary infection, the first occurring as blossom blight, the second as late twig infection. Antibiotic sprays, while controlling the first type of infection, are relatively ineffective against the second. Pruning in conjunction with the spray programme may provide satisfactory control.

McGlasson (W. B.). **The gas storage of Packham's Triumph Pears.**—*J. Dep. Agric. S. Aust.*, 59, 7, pp. 271–273, 1 fig., 1956.

In a preliminary test in 1954 pears of the variety Packham's Triumph, picked in March, 1954, at Belair, South Australia, were successfully stored to the end of October at 32° F. in a gas mixture of 5 per cent. carbon dioxide, 16 per cent. oxygen, and 79 per cent. nitrogen, whereas air-stored fruit was finished by September [cf. *R.A.M.*, 34, p. 41].

In 1955 the trial was extended to pears from all the main growing districts. Superficial skin scald was severe in air-stored fruit by mid-October, whereas quality remained good in the gas-stored until the end of November. High humidity, secured by sealing in a tank in the gas-tight room, controlled shrivelling round the neck without increasing [unspecified] mould wastage.

Fridlund (P. R.) & King (T. H.). **Survival of the necrotic ring spot virus in Plums during periods of extremely cold weather.**—*Plant Dis. Reptr*, 39, 11, p. 807, 1 graph, 1955. [Photo-offset.]

During the cold periods of the 1952 and 1954 winters, when temperatures fell

below —25° F., Mount Royal prune plum trees and one *Prunus salicina* × *P. americana* in Minnesota known to be infected with the necrotic ring spot virus [*R.A.M.*, 30, p. 572] were indexed with positive results. It appears that the virus probably cannot be inactivated by low temperatures without also killing the host plants.

Fernández Valiela (M. V.) & Bakarcic (M.). **Nuevas enfermedades del Ciruelo en el Delta del Paraná.** [New diseases of Plum trees in the Paraná Delta.]—Reprinted from *Idia*, 84, 7 pp., 11 figs., 1954.

Three new and severe diseases have recently appeared among plum trees in the Paraná Delta region of Argentina [cf. *R.A.M.*, 3, p. 260]. The first, a chronic condition termed internal wood rot, affects trees (chiefly of the variety Abundancia) raised from root suckers and over six years old. It is characterized by the withering and death of the branches, particularly during the growing season, the number affected increasing annually until the tree dies. Sections through the branches and trunk reveal either a generalized necrosis of the woody tissues extending to the cambium, or else a lateral necrosis affecting only one side of the trunk. In the latter case there may be a dead branch but the necrosis is internal only, forming a brownish-yellow discoloration extending linearly to the branches and sometimes to the roots. The point of entry of the pathogen determines which syndrome will develop. Although the causal agent has not been definitely established, *Fusarium lateritium* was frequently isolated, produced both syndromes on inoculation, and was reisolated from affected plants; if it is indeed the pathogen, it probably gains normal entry by root wounds made during transplanting. One case of lateral necrosis of the wood and bark at the base of the trunk was encouraged to heal by removing the affected parts and painting the wound with Bordeaux paste. It is advisable not to use root suckers but trees grafted on wild seedling stocks.

Canker of the fruit and branches occurs severely in the varieties Cristal, Ferrara, and Amarilla de Fábrica, and less severely in Gigaglia, Botafogo, and Independencia. Towards December the current year's growth develops violaceous-chestnut depressions, and after about two months the bark splits down to the wood. In subsequent years these lesions become deep cankers on all the branches, rendering them unproductive. The symptoms on the fruit, which occur less frequently and not until it matures, comprise round, wet, superficial, dark violaceous spots, slightly sunken in the centre and of a corky consistency. As the fruit expands the affected part splits and the healthy tissue calluses. Isolation experiments have yielded a bacterium which has produced symptoms resembling those in nature, but the possibility of a causal virus cannot be excluded. The widely-cultivated varieties Reine Claude and Santa Rosa growing near the affected trees were not attacked. Torterello, Negra, Gigaglia, and Remolachita showed very slight symptoms. At present only resistant varieties should be grown.

The third and most serious disease appears to be confined to the Carapachay region where it has been spreading slowly since 1942. An initial irregular yellowing of the leaves is succeeded after December by marginal scorching. Although even severely affected trees bud normally in the spring with no visible symptoms, the scorching becomes more severe year by year, causing arrested development and the production of short, weak shoots, until after three to four years the tree dies. The readiness with which the disease is transmitted by grafting indicates a virus agent. The varieties Reine Claude, Santa Rosa, Abundancia, Ferrara, Paz, Remolachita, and Flor de las Cañas are highly susceptible, Gaddi, Ortiz, and Tricerri less so. No plants or plant parts [of plums from the area] should be transported or used for propagation purposes.

Capretti (C.). **Alterazioni di probabile natura virosica nel Susino e nel Cotogno.** [Changes of a probable virus nature in Plum and Quince.]—*Riv. Ortofloro-fruttic. ital.*, 38, 11–12, pp. 442–446, 4 figs., 1954. [English summary.]

In August, 1954, two Shiro plum trees growing near Florence showed a mosaic-like chlorosis affecting the leaves that had developed in the middle of March. A close network of pale yellow or almost white lines about 1 mm. wide was present on the blades, following the main and secondary veins; the spaces between were a normal green and the affected area was often confined to one part of a leaf. Each branch bore one to six affected leaves, those borne subsequently being apparently normal. Neighbouring plum trees appeared to be quite healthy. The average daily temperature in March and during the first ten days of April never rose above 16° C. From the available evidence the author considers that the condition was probably caused by peach line-pattern virosis virus [cf. *R.A.M.*, 25, p. 218].

Leaves of quince trees growing on the same farm presented a pale yellow discoloration in the middle, which gradually shaded off along the main and secondary veins into pale green and then into a deeper green. Only two to ten of the oldest leaves of each branch were affected. This condition was probably also due to a virus and grafts are to be made from both hosts.

Wilson (N. S.), Jones (L. S.), & Cochran (L. C.). **An eriophyid mite vector of the Peach-mosaic virus.**—*Plant Dis. Reptr*, 39, 12, pp. 889–892, 2 figs., 1955. [Photo-offset.]

An apparently undescribed species of *Eriophyes* is reported to be a vector of peach mosaic virus [*R.A.M.*, 35, pp. 285, 375]. Near Riverside, California, it was found on infected peach trees beneath the closely adhering bud scales and on plums (*Prunus angustifolia*, *P. hortulorum*, *P. munsoniana*, *P. mexicana*, and *P. cerasifera*) also on rudimentary leaves of new growth. The virus was transmitted by the mite from peach and plum to peach seedlings in the greenhouse. The same species of *Eriophyes* was later collected from mosaic-infected orchards in western Colorado, Arizona, and New Mexico.

Vasiljević (L.). **Proučavanje nekih osobina Monilia spp. kod nas.** [A study of some characteristics of *Monilia* spp. in our country.]—*Zasht. Bilja* (*Plant Prot., Beograd*), *1955*, 32, pp. 3–16, 4 pl., 6 graphs, 1955. [English summary.]

Investigations were carried out at the Institute of Plant Protection, Beograd, Yugoslavia, on some characteristics of *Monilia* (*Sclerotinia*) spp. occurring on fruit trees in the vicinity of Beograd [*R.A.M.*, 34, p. 604]. They were grown on artificial media, that containing onion proving best for all species. On naturally infected plum, apricot, and sour cherry fruits the conidia of *S. laxa* measured 10 to 23 (average 15 to 17) μ, and those of *S. fructigena* on apple, pear, and quince, 13 to 29 (23) μ. After cross-inoculation from plum to apple the conidia of *S. laxa* were 4 μ larger than on the original host, while those of *S. fructigena* from apple and pear, inoculated on stone fruits, were reduced by 3 to 8 μ. When the two species were inoculated simultaneously on the opposite sides of an apple, conidia of *S. fructigena* appeared in five days and those of *S. laxa* in 12, the diameter of the lesions being 6·4 and 5·3 cm., respectively, on the twelfth day.

Artificial inoculations showed that the species are not exclusively pathogenic on one group of hosts but can infect the fruits, buds, and flowers of other hosts. This emphasizes the need to apply control measures to all the varieties of fruit in any one orchard.

Cadman (C. H.). **Studies on the etiology and mode of spread of Raspberry leaf curl disease.**—*J. hort. Sci.*, 31, 2, pp. 111–118, 4 figs., 1956.

Scottish leaf curl [*R.A.M.*, 35, p. 349] is etiologically distinct from the American

alpha and beta leaf curls of raspberry, which are transmitted by *Aphis rubiphila* [10, p. 195]. The prefix 'Scottish' should therefore be retained, though the causal virus (or viruses) should be called raspberry ring spot virus (or viruses) [34, p. 771].

The nicotine sulphate used for extracting the virus from leaves [loc. cit.; 35, p. 349] is applied at the rate of 4 ml. of 40 per cent. solution per 30 gm. of leaf. Sometimes one or several distinct viruses were isolated from individual raspberry plants from a given plantation. An isolate from one leaf-curled raspberry produced four distinct kinds of lesion on *Datura stramonium*, and viruses from each kind of lesion caused distinctive lesions in *Hyoscyamus*, *Datura*, and *Nicotiana* species. Viruses from different localities varied widely.

In a search for the source of virus no infected wild *Rubus* spp. were found. Nine common weeds, including *Myosotis arvensis*, *Polygonum convolvulus*, and *Heracleum spondylium* yielded virus producing ringspot in *Petunia* and *Nicotiana rustica*. There is no consistent correlation, however, of leaf curl in raspberry with the abundance of ring spot in weeds. All attempts so far to infect raspberry seedlings with virus from beet or weeds have failed. The viruses causing leaf curl are, however, known to be perpetuated on the site long after susceptible raspberries have been killed (in one case over 11 years), and are probably carried in other hosts.

Both raspberry and beet plants became infected at all times in the growing season, raspberries sometimes within five weeks of planting. Attempts made over ten years to find an insect vector of these viruses have failed. The known facts and the mode of spread of the disease along rows in the field would seem to point to soil transmission and possibly a soil-inhabiting vector, but none has yet been found.

Gourley (C. O.). **Green petal of Strawberry in Nova Scotia.**—*Plant Dis. Reptr*, 39, 11, pp. 808–809, 2 figs., 1955. [Photo-offset.]

Symptoms resembling those of strawberry green petal virus [*R.A.M.*, 35, p. 467] were observed in 1952 on a few plants of Senator Dunlop in the Annapolis Valley, Nova Scotia. In 1955 the condition was found in all the plantations examined, affecting up to 5 per cent. of the plants, the varieties including Temple and Catskill.

Smeets (L.) & Wassenaar (L. M.). **Problems of heat spot in Fragaria vesca L. when indexing Strawberry selections for viruses.**—*Euphytica*, 5, 1, pp. 51–54, 3 pl., 1956. [Dutch summary.]

Strawberry selections are tested for virus infection at the Institute of Horticultural Plant Breeding Wageningen, Holland, by runner grafting in the autumn and winter. Sufficient runners are obtained only at 23° C. and at this temperature the indicator plants (*Fragaria vesca*) developed 'heat spot' reminiscent of virus infection, characterized by small, yellowish dots on the youngest leaves, scattered at first but later coalescing to impart a chlorotic appearance. The leaves became blistered and often developed deeply indented margins. As these symptoms became less distinct at a constant temperature of 17° and were absent from newly developed leaves the indicator plants were transferred to 17° after two successful unions had been obtained at 23°.

Champion (J.). **La culture bananière aux Antilles et en Amérique centrale III. La culture bananière en Amérique centrale isthmique.** [The Banana industry in the West Indies and Central America III. The Banana industry in the central American isthmus.]—*Fruits d'outre-mer*, 10, 1, pp. 3–23, 26 figs., 13 graphs, 3 maps, 1955.

The third paper in this series [cf. *R.A.M.*, 34, p. 656] deals with all aspects of banana cultivation in Guatemala, Honduras, Salvador, Nicaragua, Costa Rica, and Panama. In Honduras Panama disease (*Fusarium oxysporum* var. [f.] *cubense*) is widely controlled by flooding badly affected plantations [34, p. 43]. The area to

be treated must be sufficiently flat that the depth of water does not vary more than 1 or 2 m., be at least 100 ha., with a slope of no more than 1 per cent., and clear of vegetation. Banks 5 to 10 m. wide at the base are erected with bulldozers and mechanical shovels. Prior to their erection the ground is roughly levelled, and supply canals and sluices constructed. The land should be submerged for about nine months, after which it can be planted for four or five years before further flooding is necessary. At Almirante, after 20 years' lapse of production due to Panama disease, 900 ha. were planted in 1953 after flooding, and 1,400 ha. were expected in 1954.

Patron (A.). **Étude des effets de Cercospora musae sur les Bananes des Antilles.** [A study of the effects of *Cercospora musae* on Bananas in the West Indies.]—*Ann. Inst. Fruits et Agrumes colon., Paris, 1952*, 4, 8 pp. 2 graphs, 1952. [Mimeoprinted. Received August, 1955.]

The results are presented of a detailed physico-chemical study of the fruits of *Musa sinensis* var. Grande Naine [Giant Cavendish: *Trop. Agriculture, Trin.*, 31, 3, pp. 126–130, 1954] banana obtained in Guadeloupe from both healthy plantations and others severely infected by *Cercospora musae* [*Mycosphaerella musicola*: *R.A.M.*, 26, p. 250; 34, p. 734, and following abstracts]. Fruits in eight different stages of ripeness, from 'completely green' to 'yellow, with large brown patches' were examined. The chief difference found was that fruit from infected plants, when ripe or nearly ripe, appeared to contain more tannins than that from healthy and was richer in pectins, especially at the onset of ripening. The more rapid ripening of bananas from infected plants probably results from the greater activity of diastase in them.

Calpouzos (L.). **Studies on the Sigatoka disease of Bananas and its fungus pathogen.** —70 pp., 18 figs., 1 diag., Atkins Garden and Research Laboratory, Cuba, 1955. [Photo-offset.]

In this comprehensive study of Sigatoka disease of bananas (*Cercospora musae*) [*Mycosphaerella musicola*: cf. *R.A.M.*, 26, p. 250 and preceding and next abstracts] carried out at the Atkins Garden, Cuba, Part I includes an account of the history, geographical distribution, importance and nature of the disease, and previous studies. Throughout, comparison is made between *M. musicola* and allied species. Part II deals with cultural studies of the fungus. Evidence is presented to show that wild isolates are a mixture of sporulating and sterile mycelia, stable lines of which can be isolated by selective subculturing (a procedure which the author considers might be applied with similar results to other species of *Cercospora*). In studies to determine the mode of inheritance of the sporulating character germtubes were isolated from uninucleate spore cells. It was shown conclusively that heterokaryosis does not occur in this species, nor apparently do diploid nuclei, leading to the conclusion that the character in question is inherited through the cytoplasm [cf. 33, p. 682]. Definite proof is lacking, failing the ability to produce the perfect state of the fungus in culture. In studies of the ascus state, which is present in Cuba, the author did not find the distinct differences in size between spores of *M. musicola* and those of other *M.* spp. on the banana leaf [16, p. 546] reported by Leach [26, p. 250]. Production of ascospores of *M. musicola* is relatively rare in the leaf spots, and of the two-celled *Mycosphaerella*-type spores captured in spore traps, only about one-fifth of those germinated by the author proved to be *M. musicola*. During observations on conidial isolates, spermogonia containing spermatia were observed in culture, and their formation is probably associated with specific strains; other bodies formed may have been immature ascocarps. The author suggests that absence of ascospore formation in culture may be due to immobilization of spermatia by the agar and incompatibility between spermatia and ascogonia of a single-spore colony.

Part III deals with physiological studies of the fungus. Experiments were carried out with portions of banana leaf passed through slits in a paraffin waxed paper cover (parafilm) stretched over deep saucers containing water, the cut ends of the leaves being immersed and the centre portion arched over the parafilm. These saucers were then placed in a series of large sealed vessels, each at a known relative humidity. It became apparent that a film of water on the leaf surface is not necessary for sporulation, which can take place at a relative humidity of approximately 98 per cent., but immersion of the spores in a water film is necessary for germination, thus confirming the essential role of dew in the etiology of the disease. The effect of varying temperature is much less critical. Mycelial growth occurred between pH 3 and 8, with a maximum round 6. Germ tube growth may continue over several nights before penetration of the host occurs, the germinating conidia being able to survive the hot, dry periods that may occur in the intervening days. Exposure to three eight-hour periods of 35° C. with less than 90 per cent. humidity did not prevent subsequent growth when the spores were returned to favourable conditions. On the other hand, cessation of mycelial growth occurs at about 30° and may account in part for the long incubation period before leaf spots appear.

Part IV is concerned with field studies. Sporulation occurs principally on the upper surface of the leaf and at night, and while the fungus will sporulate in some spots for a month, in others it may cease after about three weeks. Bordeaux mixture with a wetting agent, triton X-100, appeared to inhibit sporulation better than without. Conidia soon lost their viability under very dry conditions, but stored under normal atmospheric conditions were able to germinate in distilled water when 34 to 50 days old and up to 71 to 95 days in nutrient broth, though under field conditions viability lasts for a month at most. The author considers the ascospores to be less important than conidia in epiphytotics of the disease, but points out that one reason for the difficulty in controlling the former type of infection is the more rapid rate of germination of the ascospores (within five hours), which may allow of penetration in one or two evenings as opposed to five days or more that may be required by the conidia. He notes also that the process of spermatization may be affected by fungicides.

Host range studies showed that *M. musicola* could only parasitize certain species of *Musa*. In the course of the investigations a new species, *Cercospora hayi*, was found on banana leaves, but without associated lesions, suggesting it to be a saprophyte on necrotic areas due to other fungi. The densely fasciculate, 2- to 4-septate conidiophores measured 30 to 80 by 3·5 to 7 μ and the slenderly obclavate, straight to curved, 6- to 14-septate conidia 54 to 154 by 3 to 4.5 μ.

Control of leafspot by low volume spraying.—*J. agric. Soc. Trin. Tob.* 55, 4, pp. 436–438, 1955.

It is proposed to introduce into Trinidad the low-volume spraying technique for the control of banana leaf spot [*Mycosphaerella musicola*], using only 2 gals. of liquid per acre in the form of lubricating oil, that has proved successful in Guadeloupe [*R.A.M.*, 34, pp. 658–659]. A knapsack type of mist blower appears to be the most promising for local conditions.

Lentz (P. L.) & Weaver (L. O.). **A disease of Fig (Ficus carica L.).**—*Plant Dis. Reptr*, 39, 11, pp. 822–823, 1 fig., 1955. [Photo-offset.]

Phomopsis cinerascens, very rare on figs in the United States [*R.A.M.*, 27, p. 462], is stated to be responsible for canker and die-back of a single fig tree at Cheverly, Maryland. *Rhinotrichum macrosporum* [22, p. 178] and *Physalospora obtusa*, also isolated from the affected parts, are believed to have developed on the dead and dying branches.

Capretti (C.). **Particolari aspetti del 'mosaico del Fico'.** [Particular aspects of Fig mosaic.]—*Riv. Ortoflorofruttic. ital.*, 38, 7–8, pp. 268–272, 4 figs., 1954. [English summary.]

In July, 1954, fig trees of the varieties Dottato, Portoghese, Precoce di Lisbona, Pecciolo bianco, Pecciolo nero, Lucano, and Verdino, growing at Cascine (Florence), Italy, showed severe symptoms of fig mosaic virus [cf. *R.A.M.*, 34, p. 735], the outbreak probably being favoured by an exceptionally cold spring. The symptoms agreed with those previously described. The fruits on the Verdino tree showed slight protuberences, but no symptoms were noted on those of the other varieties.

Das-Gupta (S. N.), Asthana (S. N.), & Bhatt (R. S.). **Studies on the diseases of Mangifera indica Linn. VIII. Occurrence of deposits in necrotic Mangoes.**—*Indian J. agric. Sci.*, 25, 4, pp. 237–252, 2 pl. (1 col.), 5 figs., 1955. [Received May, 1956.]

In a further contribution to this series from the University of Lucknow, India [*R.A.M.*, 26, p. 205], the authors report the results of a histological examination of mangoes of ten varieties, collected from orchards in five districts of Uttar Pradesh. They included clean fruits from healthy orchards, apparently unaffected fruits from orchards where necrosis was known to occur, and fruits with slight or severe signs of necrosis.

In healthy fruit, untreated or preserved in alcohol, no trace of deposition was seen. Formalin preservative induced deposits. In unhealthy but non-necrotic mangoes there were deposits in some but not in others, but they were invariably present in unpickled necrotic fruit. Deposition starts in the vessels, extends to the ducts, and in the advanced stage extends to the adjacent parenchyma. In affected mangoes it was largely concentrated at the tip, though it did occur elsewhere in the fruit and also in the stalk.

The deposits, which have not yet been chemically identified, are very inert.

Andreucci (E.). **Olivi in vivaio colpiti dallo Pseudomonas savastanoi.** [Olives in the nursery attacked by *Pseudomonas savastanoi*.]—*Ital. agric.*, 92, 7, pp. 485–490, 6 figs., 1955.

Young olive trees in nurseries in Italy are frequently attacked by *Pseudomonas savastanoi* [*R.A.M.*, 33, p. 739]. Infection generally occurs in small, sharply delimited areas; two months after grafting, i.e., towards the middle of June, the development of the trees is noticeably poor, the percentage of successful grafts low, and tumours are already present. Infection evidently increases in severity from the periphery towards the centre of the affected area.

There is no doubt that in many cases the bacteria are brought into the nursery in apparently healthy grafting material; this should not be taken from badly affected trees. In the event of an outbreak, all diseased trees should be destroyed and the remainder treated with a copper spray [loc. cit.].

Cunningham (G. H.). **Certification of therapeutants.**—*N.Z. Gdnr*, 12, 7, pp. 531–533, 535, 539, 541, 543, 1956.

The publication of the 38th list of certified therapeutants for New Zealand cancels all previous lists [cf. *R.A.M.*, 35, p. 204]. [This information is also notified in the supplement to *Orchard. N.Z.*, 29, 2, 1956.]

Official F.D.A. tolerances listed.—*Nat. agric. Chemic. Ass. News*, 13, 4, pp. 12–15, 1955.

The tolerances of pesticides allowable for various categories of crops, as laid down by the Food and Drug Administration of the United States, are listed in full [*R.A.M.*, 35, p. 472]. The compilation also contains lists of substances innocuous

to man as well as those which should on no account be used under conditions which permit residues on fruit or vegetables prepared for market.

Electrostatic dusting.—*Parks*, 21, 7, pp. 453–454, 2 figs., 1956.

After a discussion of the principle and advantages of electrostatic dusting [*R.A.M.*, 32, p. 138], there follow brief descriptions of two commercial machines developed by Agricola Plant Protecting Chemicals Ltd., London, E.C. 2, in which the principle is applied. One, having a hopper capacity of 112 lb., is intended to be mounted on a small truck. The other, with a capacity of 40 to 50 lb., is powered by a light petrol engine and is designed to be carried by two men. The single engine both ejects the dust and creates the electrostatic field through which it passes before discharge.

Yamada (W.), Shiomi (T.), & Yamamoto (H.). **On the preventive efficacy of new fungicides against plant diseases.**—*Spec. Bull. Okayama Prefect. agric. Exp. Sta.* 50, pp. 127–152, 1 pl., 1954. [Japanese, with English summary.]

At the Okayama Agricultural Experiment Station, Japan, about 50 of the newer fungicides were compared with Bordeaux mixture and lime-sulphur against a large number of plant diseases from 1947 to 1953. Bordeaux was the best for the control of pear scab (*Venturia pirina*) [*R.A.M.*, 34, p. 460], ripe rot of vine (*Glomerella cingulata*), and angular leaf spot of Japanese persimmon (*Cercospora kaki*).

Against rice blast (*Piricularia oryzae*) Sankyo-Bordeaux [32, p. 505], ceresan-lime dust, and riogen dust (a mercurial) were to be recommended. Dithane Z-78 proved effective against wheat leaf rust (*Puccinia triticina*) and peach rust (*P. pruni-persicae*) [32, pp. 198, 322] and phygon against barley scald (*Rhynchosporium secalis*) [see above, p. 612].

Marshall (N. L.). **Effects of ziram (zinc dimethyldithiocarbamate) on the metabolism and growth of fungi.**—*Diss. Abstr.*, 15, 11, p. 1988, 1955.

Studies at the University of Maryland demonstrated that the respiration of growing and non-growing conidia of *Fusarium 'roseum'* do not differ markedly in sensitivity to lower concentrations of ziram; at higher concentrations the respiration rates were essentially the same whether nitrogen was supplied or not. The effects of ziram on the growth of *F. 'roseum'* appear to be the result of the inhibition of glucose respiration; it caused the accumulation of α-ketoglutaric acid.

Kovachevsky (I. H.) & Hristov (A.). Болести на културните растения [Diseases of cultivated plants.]—Bulgarian Academy of Sciences Scientific-Popular Series 10, 382 pp., 90 figs., 1949. [Received 1955.]

This useful book on the common diseases of economic plants in Bulgaria is divided into ten chapters dealing, respectively, with cereals, legumes, fodders, oil plants, officinal plants, cotton, tuber plants, tobacco, vegetables, and fruit. Each chapter contains brief descriptions of diseases and their control. Indexes of Latin and Bulgarian names are given and a bibliography of 264 titles is appended. Among the diseases listed the following are of special interest: *Xanthomonas malvacearum* on cotton [C.M.I. map No. 57], *Cercosporella herpotrichoides* on wheat [No. 74], *Pseudopeziza ribis* on currant and gooseberry [No. 187], *Colletotrichum lagenarium* [No. 313] and *Cladosporium cucumerinum* [No. 310] on cucurbits, *Marssonina panattoniana* on lettuce [No. 82], *Bacterium phytophthorum* [*Erwinia phytophthora*: No. 131] and *Synchytrium endobioticum* [No. 1] on potato, *Botrytis byssoidea* [No. 165] and *B. squamosa* [No. 164] on onion, and *Sclerotinia trifoliorum* on clover [No. 274].

Fulton (J. P.), Slack (D. A.), Fulton (N. D.), & Walters (H. J.). **Plant pathology laboratory manual.**—iii+82 pp., 17 pl., Minneapolis, Burgess Publishing Co., 1955. [Photo-offset. $2.75.]

In this manual, designed to accompany an introductory course in plant pathology for undergraduates, 31 common plant diseases caused by bacteria and fungi are briefly described and illustrated with notes for each on the favourable environment and control.

Basic climatic and durability tests for components for radio and allied electronic equipment.—16 pp., 4 figs., 1 graph, British Standard 2011, London, British Standards Institution, 1954. 5*s*.

This publication deals with the standards of temperature, humidity, etc., to which electronic equipment should be subjected when testing it for durability, and for behaviour in extremes of climate. For mould growth (p. 9), components should be inoculated by spraying with an aqueous suspension of spores, prepared and used as described (appendix E, p. 10), and exposed to attack for 28 days at a temperature of 28° to 30° C. in still air and at a relative humidity of not less than 95 per cent.

Greathouse (G. A.) & Wessel (C. J.). **Deterioration of materials.**—xvii+835 pp., 233 figs., 10 diags., 13 graphs, 1 col. map, New York, Reinhold Publishing Corporation, 1954. £4. 16*s*.

The third chapter (pp. 175–233, by R. A. St. George, T. E. Snyder, W. W. Dykstra, and L. S. Henderson) of this comprehensive volume deals with biological agents of deterioration. The habitat, morphology, physiology, and identification of fungi and bacteria associated with decay of various materials are briefly discussed.

In the second part of the book, dealing with the preservation of materials, there are numerous references to fungal and bacterial deterioration and its control on timber, paper, textiles and cordage, leather, plastics, rubber, and paint, and, in the third part, on electrical, optical, and photographic equipment. Lists of references are appended to each chapter.

Mirzabekyan (R. O.) & Men'kova (Mme K. A.). Проникновение и сохранение активности антибиотических веществ в растениях при испытании против фитопатогенных микроорганизмов. [Penetration into and retention of activity by antibiotic substances in plants during investigations against phytopathogenic micro-organisms.]—Изв. Акад. Наук СССР [*U.S.S.R. Acad. Sci. News = Bull. Acad. Sci. U.S.S.R.*], *1955*, 6, pp. 10–19, 8 figs., 1955.

In pot experiments at the Institute of Genetics, U.S.S.R. Academy of Sciences, to test the effect of a number of antibiotics against tomato bacterial canker (*Mycobacter* [*Corynebacterium*] *michiganense*) [*R.A.M.*, 21, p. 172], using the susceptible variety Chudo ruinka [Market Wonder], plumules were treated with 500 units of the antibiotic for 45 to 50 minutes or the main roots with 600 to 800 units for three to six hours, depending on the rate of penetration of different antibiotics, before inoculation by dipping the roots in the bacterial suspension. The culture liquid of the actinomycete strain 103 produced the greatest number of healthy plants (10 out of 12 when plumules were treated for 50 minutes and 6 out of 8 when roots were treated for four hours, as against 3 out of 12 and 9, respectively, for the untreated, inoculated controls). Streptomycin gave 9 out of 12 and 5 out of 8, penicillin 8 out of 12 and 5 out of 8 (three-hour exposure), and grisemin 7 out of 11 and 4 out of 8, respectively.

PUBLICATIONS OF THE COMMONWEALTH MYCOLOGICAL INSTITUTE

THE REVIEW OF APPLIED MYCOLOGY

THE subscription to the *Review* for the current volume is 60*s.* per annum, post free, payable in advance. Back volumes can be supplied, but the price is 70*s.* per volume, postage extra, with the exception of a few parts, which are out of print. Volumes I to XII have been reprinted and are available at 70*s.* per volume. Microfilm copies of the volumes out of print can be supplied to order.

INDEX OF FUNGI (formerly SUPPLEMENTS TO THE REVIEW OF APPLIED MYCOLOGY)

AN INDEX OF FUNGI listing new species and varieties of fungi, new combinations, and new names published since the beginning of 1940 is published half-yearly. The cost of Vol. 1, Parts 1 to 20 and Vol. 2, Parts 1 to 9 (all published to the end of 1954) is 3*s.* 9*d.* each part. The subscription price is 7*s.* 6*d.* per annum.

The Cumulative Index for Volume I, comprising pp. 289–430, is now available at a price of 25*s.*, post free. Binding-cases in buckram for Volume I can be obtained at a cost of 5*s.*, post free.

Complete bound volumes of Volume I with the cumulative index are also available at a price of £5. 15*s.* INDEX OF FUNGI. PETRAK'S LISTS FOR 1920–39. The following are now available: 1936–39, price 30*s.*; 1932–35 (original copies in Just's *Botanischer Jahresbericht*), price 45*s.*; 1931, price 10*s.*; 1930, price 25*s.*; 1929, price 10*s.*; 1922–28, price 40*s.*; 1921, price 10*s.*; 1920, price 10*s.*

DISTRIBUTION MAPS OF PLANT DISEASES

A SERIES of maps showing the world distribution of major plant diseases is now being issued at the rate of two maps each month. Of the 24 maps issued each year, six may be new editions, which in future cannot be issued free. The subscription price is 7*s.* 6*d.* per annum, post free. Back issues, in series, 5*d.* each; odd numbers 9*d.* each, postage extra. Loose-leaf binders for the maps are now available, price 20*s.*, postage extra. For a list of maps 1 to 282 see *R.A.M.*, **22**, p. 48; **23**, p. 80; **24**, p. 128; **25**, p. 96; **26**, p. 32; **27**, p. 96; **28**, p. 96; **29**, p. 112; **30**, p. 176; **31**, p. 160; **32**, p. 352; **33**, p. 654.

MYCOLOGICAL PAPERS

No. 44. STUDIES ON MICRO-FUNGI. X. *Zygosporium*. By S. J. HUGHES. 18 pp., 9 figs., 1951. 4*s.* 6*d.*

No. 45. STUDIES ON MICRO-FUNGI. XI. Some hyphomycetes which produce phialides. By S. J. HUGHES. 36 pp., 11 figs., 1951. 10*s.*

No. 46. STUDIES ON MICRO-FUNGI. XII. *Triposporium*, *Tripospermum*, *Ceratosporella*, and *Tetraposporium* (gen. nov.). By S. J. HUGHES. 35 pp., 30 figs., 1951. 10*s.*

No. 47. STUDIES ON MICRO-FUNGI. XIII. *Beltrania*, *Ceratocladium*, *Diplorhinotrichum*, and *Hansfordiella* (gen. nov.). By S. J. HUGHES. 15 pp., 10 figs., 1951. 4*s.* 6*d.*

No. 48. FUNGI FROM THE GOLD COAST. I. By S. J. HUGHES. 91 pp., 32 figs., 1 map, 1952. 20*s.*

No. 49. STUDIES ON MICRO-FUNGI. XIV. *Stigmella*, *Stigmina*, *Camptomeris*, *Polythrincium*, and *Fusicladiella*. By S. J. HUGHES. 25 pp., 15 figs., 1952. 7*s.* 6*d.*

No. 50. FUNGI FROM THE GOLD COAST. II. By S. J. HUGHES. 104 pp., 49 figs., 1953. 20*s.*

No. 51. A SUPPLEMENT TO A LIST OF PLANT DISEASES OF ECONOMIC IMPORTANCE IN TANGANYIKA TERRITORY. By G. B. WALLACE and MAUD M. WALLACE. 7 pp., 1953. 3*s.*

No. 52. A HOST LIST OF PLANT DISEASES IN MALAYA. By A. THOMPSON and A. JOHNSTON. 38 pp., 1953. 10*s.*

No. 53. THE PLANT DISEASES OF NYASALAND. By P. O. WIEHE. 39 pp., 1 map, 4 graphs, 1953. 10*s.*

No. 54. THE RUSTS OF NYASALAND. By G. R. BISBY and P. O. WIEHE. 12 pp., 1953. 3*s.* 9*d.*

No. 55. LEAF SPOT OF ALEURITES MONTANA CAUSED BY MYCOSPHAERELLA WEBSTERI SP. NOV. By P. O. WIEHE. 4 pp., 1 pl., 1953. 2*s.* 6*d.*

No. 56. BRITISH SPECIES OF PERICONIA. By E. W. MASON and M. B. ELLIS. 127 pp., 1 pl., 43 figs., 1953. 30*s.*

No. 57. KEY TO THE SPECIES OF PHYTOPHTHORA RECORDED IN THE BRITISH ISLES. By GRACE M. WATERHOUSE and ELIZABETH M. BLACKWELL. 9 pp., 1954. 3*s.*

No. 58. SPECIES OF THE GENUS PARODIOPSIS FOUND IN TRINIDAD. By R. E. D. BAKER, 16 pp., 11 figs., 1955. 4*s.* 6*d.*

No. 59. NEW SPECIES OF UREDINALES FROM TRINIDAD. By W. T. DALE. 11 pp., 11 figs., 1955. 4*s.* 6*d.*

No. 60. A PRELIMINARY LIST OF JAMAICAN UREDINALES. By W. T. DALE, 21 pp., 1 fig., 1955. 5*s.*

No. 61. THE GENUS CEREBELLA. By R. F. N. LANGDON. 18 pp., 2 pl., 6 figs., 1955. 7*s.*

No. 62. A REVISION OF THE BRITISH HELOTIACEAE IN THE HERBARIUM OF THE ROYAL BOTANIC GARDENS, KEW, WITH NOTES ON RELATED EUROPEAN SPECIES. By R. W. G. DENNIS. 216 pp., 1 pl., 179 figs., 1956. 60*s.*

No. 63. A PRELIMINARY LIST OF PLANT DISEASES IN NORTHERN RHODESIA. By E. A. RILEY. 28 pp., 1 map, 1956. 9*s.*

No. 64. USTILAGINALES OF WEST PAKISTAN. By S. AHMAD. 17 pp., 8 figs., 1956. 6*s.*

Numbers are issued at irregular intervals. Until further notice a rebate of 33⅓ per cent. is allowed on new Papers to those who register for all numbers as issued, the charge to subscribers to the *Review of Applied Mycology* being added to their subscriptions for the succeeding year, others being billed annually. A binding-case for Mycological Papers 1–25 is now available, price 5*s.*, postage extra.

ALL publications are post free and, with the exception of Mycological Papers, all subscriptions are payable in advance. Foreign subscribers should pay by International Money Order or through the British Agents of their Bankers. Orders and correspondence should be addressed to the DIRECTOR, COMMONWEALTH MYCOLOGICAL INSTITUTE, FERRY LANE, KEW, SURREY.

CONTENTS

AUTHORS' NAMES

SUBJECT INDEX